Refuge Notebook

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USFWS Kenai National Wildlife Refuge

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Refuge fire manager uses off-season for reflection and planning

by Doug Newbould

As we begin a New Year, many of us find ourselves looking back over the events, the challenges and accomplishments of the past twelve months—even as we prepare our plans for the year ahead. Since March, refuge employees have written approximately forty articles about the wonderful lands, the wildlife and the people of the Kenai National Wildlife Refuge. I believe I can speak for all at the refuge when I say, "Thanks a lot" to the *Peninsula Clarion* for giving us the chance to share our work with you. Our hope is these articles will help you better understand your local wildlife refuge and its mission.

Everything I have heard so far indicates the column has been successful. So until the Clarion pulls the plug or we run out of things to say, we will be happy to continue.

Some of you might be interested to know what a fire manager does in the off-season, when he or she is not out fighting wildland fires or using fire to reduce hazard fuels and improve wildlife habitat. The short answer to that question is reflect and ponder. We reflect on the successes and failures of the past, and ponder the actions we must take in the future. The biggest challenge for me is that both reflecting and pondering tend to require a great deal of paperwork.

Some people might think that Smokey the Bear hibernates every winter like any normal bear. Au contraire! I'll have you know that Smokey is a personal friend of mine, and we have had many a discussion about the amount of paperwork a fire manager must complete these days.

The truth is that Smokey and I cannot afford to relax in the off-season. We have to get ready for the next fire season. There is equipment to repair and replace. There are fire management meetings and training sessions to attend. There are seasonal firefighters to hire. There are budgets, fire management plans and burn plans to prepare. There are schools and students to visit. The list goes on. The fact is that fire management on the refuge and everywhere else, is a full-time, year-round job.

I want to tell you about some of the fire management accomplishments of 1999, and some of the things we are planning for 2000. Last year, we successfully burned about 400 acres of black spruce forest out at Mystery Creek. The primary objective of the prescribed burn plan at Mystery Creek is to reduce the hazards of wildland fire by converting large continuous stands of black spruce to less flammable species like birch, willow and aspen. When we accomplish our primary objective, we receive the additional benefit of improving winter habitat for moose and hare. Five units (about 4000 acres) remain to be burned at Mystery Creek, and our plan is to complete as many of those burn units as possible in 2000.

The other major accomplishment of 1999 was the Funny River Road Hazard Fuel Reduction Project. Between April and August, refuge firefighters successfully burned about three thousand slash piles on seventy-five acres along the south side of the Funny River Road, between Soldotna and Funny River. Our plan is to complete the remaining sixty-five acres of thinning, piling and burning before the summer of 2001.

Another highlight of the year for me was training/qualifying twenty new firefighters here at the refuge. Basic firefighter training consists of three modules: basic fire behavior, basic firefighting tactics and firefighter safety (Standards for Survival). Trainee firefighters must successfully complete this forty-hour basic training and a work capacity test before they are allowed to work on a wildland fire or prescribed burn. The work capacity or Pack Test requires a trainee to walk three miles carrying a forty-five pound pack in less than forty-five minutes.

Refuge firefighters successfully completed several wildland firefighting assignments here in Alaska and down in California last year. These off-refuge assignments are important both to the firefighter and to the national wildland firefighting effort. Every wildland and prescribed fire experience strengthens a firefighter's knowledge of fire behavior in different fuel types and terrain, under different weather conditions. These experiences also build strength in the national

firefighting organization, by preparing a cadre of firefighters that can respond to many types of incidents throughout the country.

The refuge got some tough news in December when the Fire Management Officer, Larry Adams, resigned. Larry takes over thirty years of training and firefighting experience with him as he goes, and he will be hard to replace. We wish him well in his new pursuits (sailing around the world?), but we are hoping to use his talents on special fire projects in the future.

Well, I guess that's enough reflecting and pondering for now, I've got to get back to my beloved paperwork!

Doug Newbould is the Assistant Fire Management Officer at the Kenai National Wildlife Refuge. If you would like to learn more about fire management or other programs on the refuge, stop by the refuge headquarters on Ski Hill Road in Soldotna, call us at 262-7021, or check out our website http://www.fws.gov/refuge/kenai/.

Refuge webpage never "closed for the winter"

by Pam Ables

Have you ever wondered what birds can be found on the Kenai Peninsula? Or needed information on which lakes you can land your plane? What about a map of the ski trails located up here on Ski Hill Road? Well, you can find all that and more on the Kenai National Wildlife Refuge web site.

In 1998, I was assigned by the refuge manager to create a comprehensive web site for visitors that is useful in helping them plan trips to the Kenai Peninsula.

I got to thinking about this assignment on a trip to Anchorage one day. As I was looking for somewhere to make a "pit stop" with a squirming 10 year old in the passenger seat, I noticed that many of the summer conveniences were "Closed for the Winter." Then I came upon the Refuge's visitor contact station and profusely thanked the refuge manager for deciding to keep at least one outhouse open for the winter.

After our stop I realized that making the website only useful for visitors was the same as closing all the outhouses from here to Anchorage for the winter. This would not do and one can only buy so many sodas at the "Restrooms for customer's only" establishments, and that only has you planning your next stop thus creating a vicious cycle. Consequently the Refuge website became a project for not only visitors but for local residents as well.

Want to take the kids on a short snowshoe hike or did you get a permit for a special hunt and need information about how you can access the area? Check out our web site and look up popular day hikes or hunting information.

Visit the Kenai Refuge website at http://www.fws.gov/refuge/kenai/ and find out what's happening on your refuge this week. If you can't find what your looking for, email me with comments at Pamela_Ables@fws.gov.

Pam Ables is the computer specialist for the Kenai National Wildlife Refuge and has worked on Alaska Refuges for 13 years. She lives in Kenai with her husband, Myke and his daughter, Destiny. Previous Refuge Notebook articles can be located at http://www.fws.gov/refuge/kenai/.

So you want to be a refuge guide?

by Rick Johnston

As certain as the tourists' annual migration to the Kenai, my telephone will start ringing in a week or two with inquires about guiding on the Refuge. Several of the callers will no doubt be prospective guides from New York to Soldotna fantasizing about an adventurous and prosperous future as a Kenai National Wildlife Refuge guide. Some will wait until Memorial Day weekend to try and make their dream a reality, while others will have prepared detailed business and promotional strategies that would shame a Fortune 500 executive.

I try to steer hopeful guides in the right direction and discuss the various realities of becoming a guide. I ask pointed questions: Are you sure you want to get by on three hours of sleep a night from June 1 to October 1? Are you absolutely certain you want to turn your favorite personal recreation activity, such as fishing or boating into a modest paying job, smell like salmon eggs from June to September, live off business loans for your first two years, and live out of a suitcase at Motel 6 while drumming up business at Lower-48 sport and trade shows during the winter? Have you brushed up on your you-should-have-been-here-last-week fishing stories and tall tales? Just kidding of course; but in reality, the road to a successful guide business has many bends and can be a challenging and difficult endeavor. Prospective guides should ask themselves tough questions before making the leap.

Some persons who inquire are genuinely surprised that any official permits or oversight is required at all, on Refuge lands or anywhere else. In fact, the Kenai National Wildlife Refuge has required a special-use permit for all commercial guiding since 1980, and well before that time for other services such as the Russian River Ferry, tent camps and big game guiding. Applications are required for all forms of commercial guiding, and the permit year generally begins on May 1 and extends until April 30 of the following year, unless the permit is issued for multiple years.

The Refuge is generally supportive of proposals which reflect a sensitivity to the wildlife and fisheries resources and which consider Refuge purposes. Guide services are an important part of our overall program because they can help visitors get the most out of their experience on the Refuge. For this reason we value our guides highly and try to help them serve their clients in the best possible ways.

There are a wide variety of guide services offered to visitors at various locations on the Kenai National Wildlife Refuge. These services include big game guiding, hunter and game transporting, scenic whitewater and flatwater float trips, sportfishing, campground services, boat drop offs, air taxi service, canoe rental and drop off service, wildlife sight-seeing, and guided horseback trips. While working with the Kenai Refuge's visitor services, I have seen just about every kind of guide proposal imaginable. By far the largest number of past permits have been for guided sportfishing. Guided sportfishing on the Kenai is far from a new idea, and it is easily the most competitive venue, and hence experiences the most first and second year business failures.

During 1999, we issued more than 125 permits, 90 of which included sportfishing and related support operations, especially on the Kenai River. Wintertime and non-harvest activities had the fewest permits. Like many areas in Alaska, the Refuge has few winter or non-peak season tourism and visitor service offerings, and there is lots of potential here for the creative vendor.

As the annual April 1 application deadline approaches, I never cease to be amazed at the innovation and hard work behind some of the new guide proposals. But likewise, I am seldom denied a silent chuckle at the naivete and unlikely hope in some of the proposals. A couple of years ago, I had an out-of-state applicant talk on and on about offering a much needed fishing guide service to a secret Refuge location where only the applicant's new whiz-bang fishing guide service had the method and knowledge to assist a fishless and guideless public. When pressed for the "secret location," he finally revealed that the trade secret location was in fact the Russian-Kenai River confluence. Oh, boy…what could I say…?

In recent years, both long-time and new guides have sought less crowded locations to offer their preferred visitor service, in most instances sportfishing. Good guides try to have a variety of settings and ac-

tivities that suit the various desires and needs of their clients. Many local guides report that their clients are increasingly disappointed with the social density and crowding at many Kenai Peninsula locations. This is especially true during slow fishing times. Kenai National Wildlife Refuge locations have been increasingly sought after as less crowded and wilder destinations for clients trying to experience the real Alaska. Seeing Alaska wildlife is a high priority for many visitors, even when fishing, hunting or boating is their primary activity. As Refuge destinations such as the Upper Kenai River have become more popular, we have placed limitations on guided use to maintain less crowded social conditions and to insure that the Refuge's wildlife populations and wildlife habitat are protected.

The Refuge has established certain permit conditions for various guided activities. Permit conditions seek to provide safety for guides and their clients, to protect Refuge resources and wildlife, and in some cases to limit congestion at Refuge locations. Depending upon the particular service a prospective guide wishes to provide, the State of Alaska and other federal agencies may have further requirements and regulations that are applicable. For example, big game guides, commercial air taxis, boat operators, and Kenai River guides must obtain additional licenses or permits from such agencies as ADF&G, Coast Guard, and FAA. Fees may be collected, based on actual client use-days and the type of activity.

If you are thinking of starting a guide business, don't forget to do your homework; talk to other guides and knowledgeable persons, and most importantly focus on your target clientele. If you have further questions regarding the Kenai National Wildlife Refuge visitor services, application deadlines, and permit requirements, contact us at Refuge Headquarters at 262-7021 for more information.

Rick Johnston has a Ranger/ Pilot for the Kenai National Wildlife Refuge since 1979. Previous Refuge Notebook columns can be viewed on the Web at http://www.fws.gov/refuge/kenai/.

Warm summers, not human beings, control spruce bark beetles

by Ed Berg

After ten years of massive spruce bark beetle mortality, I am hearing fewer calls that we "do something" about the spruce bark beetles. Early on, the Forest Service was criticized for not stemming the beetle advance in Cooper Landing and Moose Pass. Slash left along the Bradley Lake powerline was blamed for starting the beetle outbreak in Kachemak Bay. Beetle-infested logs (from Ninilchik) piled on the Homer Spit were seen as beetle nurseries that would feed beetles into the city of Homer.

My basic take on all this is that we human beings had nothing to do with the bark beetle outbreak (apart from perhaps warming the global climate). We were caught in a rising tide, and "time and tide wait for no man," as they say. The rising tide is climate warming, starting in 1976 and intensifying in 1987. Beetles like warm summers and we had a string of remarkably warm summers from 1987 through 1997.

The accompanying graph compares several climate indicators with the annual "red-needle" forest acreages, from Forest Service aerial surveys. After the beetles kill a spruce tree, the needles turn red in the following spring and then start dropping off. Red-needle acreage figures thus represent fresh kill, not total kill over a period of years. It usually takes 2-3 years from the time that beetles enter a stand to generate red-needle trees. (Keep this 2-3 year lag in mind—its importance will be explained below.)

I see two distinct warming effects in the graph: drought stress and a "long warm summer" effect. The post-1987 warm summers have increased evapotranspiration: we have more evaporation from soil and water, and more breathing out of water by plants (transpiration). We see the results in dried ponds and falling lake levels around the Peninsula. This loss of water can produce drought stress in trees and make them more susceptible to all kinds of infestations and diseases, as well as to forest fires. Drought-stress is particularly severe in the spring when sunshine and warm air temperatures turn up photosynthesis in the leaves (needles). The leaf pores (stomates) open wide and breathe out water, but frozen soil prevents water uptake from the roots. Low water pressure in the tree reduces the trees' ability to pump pitch into the beetle borrows, which would immobilize the beetles. The beetles have evolved the timing of their mating flight to new trees at just this moment when the trees "have their pants down," i.e., usually late May or early June.

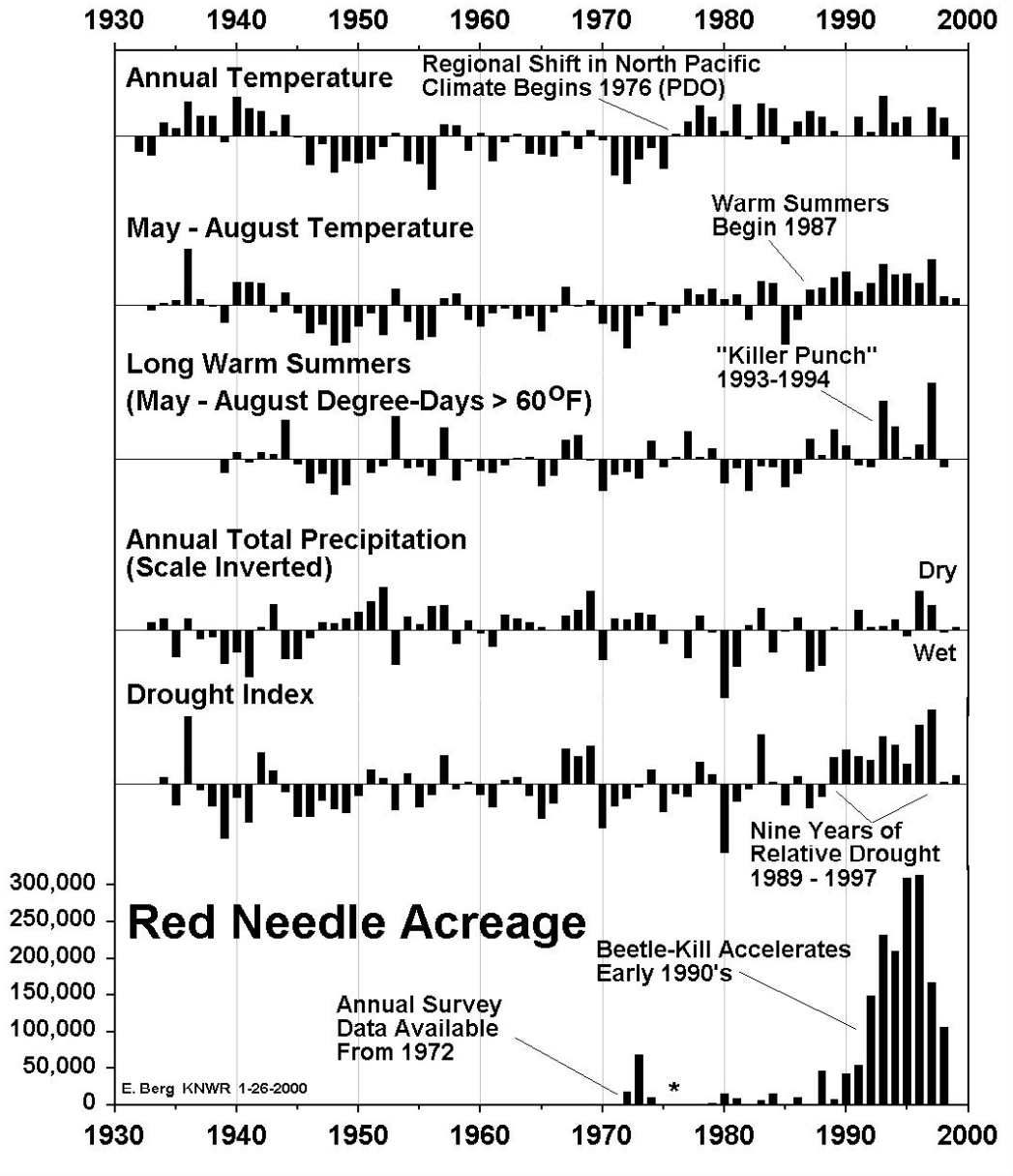
The Drought Index (based on May-Aug temperatures and Oct-Sept total precipitation) clearly shows an unprecedented run of drought years from 1989 through 1997. Red-needle acreages really take off in 1992, three years after the drought began. (Remember, it takes 2-3 years of beetle activity to turn the needles red.)

The "long warm summer" effect is more subtle, but it's the killer punch. Normally the bark beetles have a two-year life cycle: the eggs are deposited in the spring (after the mating flight) and they hatch into larvae (white grubs) in the summer. They overwinter as larvae, then become adults (pupate) during the next summer. They spend a second winter in the tree, and then make their mating flight to a new tree in the following spring (two years after hatching). This is the standard pattern, but in a long warm summer they can go all the way to adulthood by the first fall, and hence spend their first winter as adults rather than as larvae. This "accelerated graduation" produces slightly smaller beetles, so that in the next spring one sees two sizes of beetles flying. I saw this, for example, in the Fritz Creek area in 1998, following the record long warm summer of 1997. Releasing two generations of adults (one- and two-year beetles) simultaneously doubles the beetle population.

To measure the long warm summer effect, I calculated Degree-Days Above 60°F. These Degree-Days are the opposite of heating degree-days that are used for winter fuel oil calculations; they represent total summer warmth available for beetle growth and activity. I used 60°F as the benchmark because bark beetles need 60°F days in the spring before they can make their mating flight. On the graph we see alot of degree-days in 1993 and 1994. This two-year double-whammy, added on top of accumulating drought stress, was the

killer punch that brought the southern Kenai Peninsula spruce forests to the mat in 1995 and 1996 (with red-needles over 300,000 acres each year). Everything since 1996 has been mop-up. Red-needle acreages have declined dramatically since 1997 because there is not much mature spruce forest left to kill: the beetles have eaten themselves out of house and home.

Given the warm summers, I see nothing that we could have done to stop the overall outbreak. At low beetle densities, landowners can take defensive actions such as thinning, pruning lower branches, spraying carbaryl, and burning trap trees. But when the climate tide rises, as it did beginning in 1987, the rules all change, and the beetles take charge.



Climate indicators (from the Homer airport) are standardized to show trends above and below the long-term averages. Red-needle acreages include drainages from Tustumena Lake to the Anchor River.
[*] Survey was not done in 1976.

It is worth noting on the graph that we have just experienced two relatively cool and drought-free summers. It is possible that we have entered a relatively cool period, which could last 20 to 30 years, similar to that of the mid-1940's to 1975. A 20-30 year cycle in a 100 year record of North Pacific sea surface annual temperatures has recently been identified, and named the Pacific Decadal Oscillation (PDO). Kenai and Homer track this record rather closely (correlations of +76% and +80%, respectively). If this cycle is real, we are due for a cooling. I'll explore this in a future column, but interested readers can check out this research at http://www.atmos.washington.edu/~mantua/abst.PDO.html. If summers continue to cool, our remaining spruce trees may survive; so don't be too quick to cut your green trees on the expectation that they will all die sooner or later. The end of the outbreak may be in sight!

Ed Berg has been the ecologist at the Kenai National Wildlife Refuge since 1993. He also teaches geology at the Kenai Peninsula College in Soldotna and Homer. Previous Refuge Notebook columns can be viewed on the Web at http://www.fws.gov/refuge/kenai/.

Swamp fires—a look at fire management in the South

by Alicia Duzinski

Hundreds of gators were resting along the banks of the Suwannee Canal, one of the few remaining open water holes on the Okefenokee National Wildlife Refuge, located in southeast Georgia where I worked last summer. As I walked down to take water-level readings, the gators slid and splashed into the water in a domino effect. The heat index was 115°and lightning cracked as enormous bolts of energy struck the earth, causing the purple afternoon sky to glow a supernatural hue. At this point, the water levels in the swamp were so low and the vegetation so dry that any lightning strike could cause a potentially serious wildfire.

During the summer of 1999, southeast Georgia and Florida experienced extreme drought conditions and volatile fire behavior. Water-levels in the 396,000-acre watershed that is the Okefenokee National Wildlife Refuge dropped an inch per day. In the summer months, violent lightning storms rock the swamp with over 500 lightning strikes on any given day. The swamp is made up of diverse habitats: from the dark cypress lined waterways to floating islands covered with trees and shrubs, from open water prairies to mats of floating peat that give the Okefenokee its Seminole name "land of trembling earth."

Flying over the Okefenokee NWR, it is striking how it resembles parts the Kenai Peninsula, with its peat moss, waterlilies, lakes, islands, and pockets of upland timber. The Okefenokee swamp has a certain mystique with its islands of southern pine, cypress-lined waterways and plants with names that roll off the tongue, like ti-ti, fetterbrush, sweet bay, loblolly, and pepperbush. This lush green vegetation is deceiving because it can burn violently under conditions that we would consider unburnable in Alaska.

Okefenokee NWR has a cooperative agreement with the State of Georgia Forestry Commission for fire suppression duties, similar to the Kenai NWR's agreement with Alaska State Forestry. Fire is such a natural part of the culture in the South that people don't really get that worried when they see smoke. All year long, the refuge conducts prescribed burns to return the upland areas to the native longleaf pine-wiregrass habitat for the endangered Red Cockaded Woodpecker. The timber companies bordering the swamp burn slash piles after harvest, so it is not unusual to see smoke on any given day. However, large-scale fires that threaten life and property are given full attention, and national resources were called into fight the huge fires that occurred last summer.

Lightning strikes started last summer's two large fires on the Okefenokee. The 14,000-acre Hickory Island fire ignited in April and continued smoldering into June. We were on alert for any threats to surrounding homes and timber company lands. The Friendly Fire broke out on the Florida border in June and eventually crossed into Georgia and the swamp. Extreme fire behavior caused almost 30,000 acres to burn over during one afternoon, and the fire consumed 70,000 acres before it was contained. Thousands of acres of slash pine belonging to Rayonier Inc., Toledo Manufacturing, Superior Pine and International Paper companies were burned in the fire.

In 1994, the Greater Okefenokee Association of Landowners (GOAL) was formed due to concerns over the danger and expense of fighting wildland fires. The group consists of 80 local landowners who collectively represent over 2 million acres of land surrounding the Okefenokee. The refuge works closely with GOAL members to maintain the swamp's edge break, a 200-mile fuel break around the perimeter of the Okefenokee. This fuel break acts to prevent fire from entering or leaving the swamp and makes it safer and easier to fight fires in the remote areas around the swamp. The GOAL members built and paid for helicopter dip sites every three miles around the swamp, most of which are on private land.

Similarly on the Kenai Peninsula, neighborhood groups are working with the Kenai NWR and state and local fire protection officials through Project Impact to help prevent fire from threatening their homes and families.

Fire is critical to the Okefenokee swamp. Without fire, the natural process of forest succession would cause peat buildup, allowing shrubs to grow. Eventually a hardwood forest would take over, sucking up the precious water supply. Historically, lightning has kept this process in check by generating large-scale

fires that keep the waterways open and remove the shrub buildup from the forest floor.

Alicia Duzinski is the Fire Program Technician at the Kenai National Wildlife Refuge. She spent the summer working as a wildland firefighter on the Okefenokee National Wildlife Refuge in southeast Georgia. If you would like to learn more about fire management or other refuge programs, stop by the refuge headquarters on Ski Hill Road in Soldotna, call us at 262-7021, or check out our website at http://www.fws.gov/refuge/kenai/.

Animals, as well as humans, get stranded on the Kenai Peninsula

by Ted Bailey

The recent avalanches that stopped people from traveling to and from the Kenai Peninsula are a reminder how isolated the Kenai Peninsula is from mainland Alaska. Travel by air was still possible, but people using ground transportation were stopped in their tracks. A similar situation applies to certain species of wildlife trying to leave, or to find, the peninsula. Because birds travel by air, they have little difficult finding and leaving the peninsula, but mammals have more difficulty, because they travel on the ground. Picture wildlife somewhere on the Kenai Peninsula with no knowledge of geography, no "road" system, and an urge to travel. How long would it take them find their way off the peninsula? Or picture wildlife under the same conditions somewhere north of Anchorage with an urge to travel. What are their chances of finding the Kenai Peninsula? Translocated animals often attempt and some succeed in returning to their "home areas." But long-term radio-collar monitoring of native wolves, bears, and lynx on the peninsula show how difficult it is for certain species to leave—and probably more difficult to find—the peninsula. Consider the lynx for example.

Most resident lynx spend most of their lives in a well defined area whose size varies according to their sex, age, reproductive status, and their cyclic food supply—the snowshoe hare. However, some lynx, often young males, eventually leave their natal or birth areas and search out distant areas to settle in. These non-resident lynx are known as "dispersers." Dispersing lynx are capable of traveling great distances in a continuous habitat. Three lynx initially tagged in the Yukon Territory were later trapped in eastern Alaska and others were trapped in the Northwest Territories (now Nunavut), British Columbia, and Alberta. One Yukon-tagged lynx was trapped a record distance of 687 miles from its capture location. These Yukon-tagged dispersing lynx traveled through continuous habitat.

In contrast, the Kenai Peninsula is almost disconnected from mainland Alaska. Lynx traveling between the Kenai Peninsula and the rest of Alaska must follow narrow, forested corridors in steep mountain valleys. They must cross open alpine habitats or a wide zone of nearly treeless wetlands at the head of Turnagain Arm, and traverse through human-populated areas surrounding Anchorage. Lynx prefer to travel in dense or forested cover, and unlike wolves that will cross open areas, lynx are reluctant to cross wide, open treeless areas. Consider the following specific, but typical, example of the movements of one dispersing lynx.

We did not know where young male lynx #113 was born or where he spent his first year of life. It will forever remain a mystery. But we do know where he went, and where and when he died. We captured him one dark, snowy afternoon in late October 1996 south of Chick Lake in the northern portion of the Kenai National Wildlife Refuge near the Moose Research Center. He was an average young male lynx that weighed 19 pounds, and like other lynx we had captured, we attached a small radio collar before releasing him in order to monitor his movements, home range, habitat use, and survival.

Nearly a month later we found #113 about 20 miles away, along the coast of Cook Inlet at Point Possession near the very northern tip of the Kenai Peninsula. He could go no further north or west because of the large expanse of water. From there he turned back to the south and returned to the area where he was captured—possibly his area of birth—that encompassed the entire Swanson River Canoe System. His movements traversed back and forth across this area until May 1997 when he departed again in the opposite direction, to the southeast, and crossed the Kenai River above from Skilak Lake sometime in mid-June. By early July his travels had taken him deep into the Kenai Mountains and high up into a spruce-alder valley southeast of Upper Russian Lake, near Goat Lake. We found him there near yet another barrier to his wandering movements, but this time it was glaciers and ice—the Harding Icefield. By early August he had turned back again to the west, left the mountains behind and was traveling southwest across the Kenai Benchlands north of Tustumena Lake. He most

likely skirted the west end of Tustumena Lake, crossed the Kasilof River, and by early September was east of Homer on the north side of Kachemak Bay overlooking yet another barrier of water to his movements further to the south. He turned back north.

In late September 1997, nearly a year after his capture and after wandering the length and breath of the Kenai Peninsula and encountering the Cook Inlet and Harding Icefield, #113 apparently had found a place to his satisfaction on the southwestern forested slopes of the Caribou Hills. He settled there and established himself as a stay-at-home resident, his wandering days apparently over. He remained there for over a year until he was taken in a coyote snare by a trapper in December of 1998. A microscopic section of the cementum layers in one of his canine teeth confirmed that he was three years old at the time of his death, and therefore just over a year old when we captured him back in October of 1996.

The movements of this particular lynx are typical of dispersing lynx we have monitored and demonstrate that it is very difficult for lynx to find their way off the Kenai Peninsula, and probably even more difficult for mainland Alaska lynx to find their way onto the Kenai Peninsula. We have monitored the movements of many dispersing lynx on the western Kenai Peninsula and have found similar movement patterns. Despite a dispersing lynx's ability to travel, it is very difficult to find its way off the peninsula. Of well over 100 lynx captured and monitored on the refuge over more than 15 years, we have only one documented record, years ago, of a tagged lynx successfully dispersing off the Kenai. This was also a male lynx that was eventually captured near Chitna, over 200 straight-distance miles from his last known Kenai Peninsula location. Male lynx are apt to disperse more frequently and to greater distances than females. And of well over 100 lynx radio-collared in mainland Alaska and in northwestern Canada, in the 1980's and 1990's, none ever made it to the Kenai Peninsula.

This knowledge of lynx movements and the movements of other mammals such as wolves and brown bears on the Kenai Peninsula is of significance because it relates to a tenet of animal ecology known as "island biogeography." Basically, island biogeography states that animal populations on islands, or in isolated blocks of habitat, are more at risk and susceptible to extinction than populations that are surrounded by other similar populations. The smaller the island and the more isolated from nearby populations, the greater the risk. The scientific literature is replete with examples of populations declining or going extinct on islands or within isolated or small fragments of once-continuous habitat. Specific examples also include the Kenai Peninsula.

Caribou, another great wanderer, were once native to the Kenai Peninsula but were extirpated by man in the early 1900's. Caribou had to be re-introduced to the Kenai in the mid-1960's and 1980's. Had they not been re-introduced, we would probably still be waiting, after nearly 100 years, for caribou from mainland Alaska to find and "naturally colonize" the peninsula again.

Evidence suggests that it took mainland Alaska wolves about 50 years to find and colonize the Kenai Peninsula after they were also extirpated from the peninsula in the early 1900's. As wildlife habitat shrinks on the peninsula and more human-created barriers to wildlife movements to and from the peninsula are erected in their paths, the more difficult it is for mainland Alaska and Kenai Peninsula wildlife populations to intermix, share genetic traits, and maintain themselves through emigration and immigration. The known history of Kenai Peninsula wildlife populations, as well as radio-collar studies of dispersing wildlife on the peninsula, and ecological information on the risks associated with isolated populations in general, all clearly indicate that certain wildlife populations on the Kenai Peninsula need to be managed more carefully than mainland Alaska populations.

Ted Bailey, a supervisory wildlife biologist, has been responsible for the Kenai National Wildlife Refuge's biological programs for more than 20 years. He and his staff monitor and conduct studies of a variety of wildlife populations. He and his wife, Mary, live near Soldotna. Previous Refuge Notebook columns can be viewed on the Web at http://www.fws.gov/refuge/kenai/.

Winter wildlife survival strategies: endure, hide or flee

by Candace Ward

The Kenai Peninsula's six-month long winters begin to wear on its human animals by February each year. Whenever you feel tired of winter, remember you could be spending your winter like some of the hardy wildlife residents of Kenai National Wildlife Refuge. Let's take a closer look how they cope with winter's challenges.

The small wood frog spends its winter frozen solid beneath several inches of soil and leaf litter. If you uncovered a wood frog in the middle of winter, as did arctic explorer Samuel Hearne, it would appear to be dead. He wrote in his journal in 1770, "I have frequently seen wood frogs dug up with the moss when pitching tents in winter frozen hard as ice. By wrapping them in warm skins and exposing them to a slow fire they soon recover life."

Anyone who has experienced frostbite has to wonder how wood frogs manage to completely freeze, thaw, and live. Apparently, instead of water freezing inside their cells, ice crystals form outside the cell membrane which prevents the cells from rupturing. Scientists are fascinated by this amazing survival feat and are working to solve its mystery. They hope to use the wood frog's winter survival strategy to extend the viability of organs such as hearts, kidneys, and livers used in organ transplants.

Have you ever wondered how a tiny bird like the common redpoll manages to survive those minus 40°F nights? Redpolls, the smallest birds to winter in Alaska, use snow cavities to roost at night which insulates them from outside air temperatures by as much as 40°F. Redpolls are flock birds, and they nestle down with flock-mates to increase their warmth by as much as 30%. They also pack away a dinner as they forage for seeds during the day; they store extra food in their crops which they regurgitate at night to provide fuel to survive the cold darkness. Finally, they are able to turn down their internal thermostats. Normally, they maintain a body temperature of 104°F, but on cold nights they can lower their body temperatures to 86°F to conserve energy.

Wolverines are known as hyenas of the North because of their powerful teeth and jaws and excellent ability to hunt and scavenge. They have extraordinary fur that is highly resistant to snowballing and icing. Their fur coat keeps them ice-free and well insulated in all the vagaries of winter weather from ice rain to hoar frost.

During winters with exceptionally deep snow, wolverines have been known to tackle and kill animals as large as caribou and moose. Usually, they let wolf packs do the hunting for them and clean up the remains of caribou and moose kills by consuming the leftovers including bones and hides. Some wolverines have been known to survive winter months solely by eating animal bones. Since bones contain 40% protein, bones are quite nutritious if you can break them up into small enough pieces to swallow and digest. Wolverines are well equipped to this task and crush bones with their powerful teeth and jaws.

Generally, wild animals cope with winter in three ways: they endure it like the wolverine, moose, and caribou; they hide from it like brown bear, wood frog, and marmot; or they flee from it like migratory birds such as common loons, robins, and swallows. During winter many of us are lucky enough to use the migratory bird strategy to escape to warmer climates like Hawaii and Mexico. We may even encounter our summer birds friends such as golden plovers in Hawaii or common loons in Baja California in our southern travels. Fortunately, spring is only two months away and those same birds will head our way to find mates and food in the Land of the Midnight Sun. Winter will become a distant memory to all of us as we revel in the long daylight and warmer temperatures of spring and summer.

An excellent resource book on how wildlife survive winter, which I used as reference material for this article, is *A is for Arctic: Natural Wonders of the Polar World' by Wayne Lynch. This book is available at the bookstore at Refuge Headquarters on Ski Hill Road.*

Candace Ward has worked as park ranger at Kenai National Wildlife Refuge for 15 years specializing in refuge information and education programs. For more information on Kenai National Wildlife Refuge, including past Refuge Notebook columns, check out our website at http://www.fws.gov/refuge/kenai/.

Ice fishing on the Kenai National Wildlife Refuge

by Mimi Thomas

Have you considered ice fishing this winter? There are plenty of opportunities for you on the Kenai National Wildlife Refuge. You may have to overcome some access difficulties to reach some of the lakes, but once you begin fishing, the first bite from a big fish makes the effort worthwhile. Many of the more popular ice fishing lakes are sometimes hard to access without 4-wheel drive or a snowmachine, and you may have to walk, ski or snowshoe to certain lakes because snowmachine use is prohibited in those areas. (Copies of snowmachine and fishing regulations can be picked up at Refuge headquarters on Ski Hill Rd.)

Waters on the Kenai National Wildlife Refuge contain salmon, trout, grayling, and char. Many of my patrols on the Refuge have enlightened me as to some of the more popular places to catch these fish. My travels bring me into contact with many people that are out and about doing their best to catch the "big one." One of the most happening places seems to be Skilak Lake near the outlet, where it flows into the lower Kenai River. Recently I have talked with several people who have been fortunate enough to bring in good sized rainbow and lake trout from this location. The limit for rainbow trout in Skilak Lake is one per day and one in possession.

Hidden Lake is also one of the more popular ice fishing spots. The lake is located about 3 miles from the east entrance of Skilak Loop Road. Unfortunately, it is sometimes difficult to access the lake if Skilak Loop Road hasn't been plowed. The limit and possession for Rainbow Trout from Hidden Lake is five per day, and only one 20 inches or more.

Off-road vehicles, such as 3- and 4-wheelers, are not permitted anywhere on the refuge, including on lake and river ice. Licensed highway vehicles are permitted on Hidden, Engineer, Kelly, Peterson, and Watson Lakes for ice fishing purposes only, and you must enter and exit these lakes via existing boat ramps. Snowmachines are prohibited within the Skilak Loop Special Management Area, except on these same lakes for ice fishing purposes only. The boat launches at Upper and Lower Skilak Lake campgrounds may be used for snowmachine access to Skilak Lake.

Swanson River Road and Swan Lake Road are well used in the winter to access the smaller lakes in the area. Swanson River Road runs north from the Sterling Highway at the Sterling Elementary school. Near the end of Swanson River Road you can turn right on Swan Lake Road which will take you another 10-11 miles to the east, before reaching a locked gate. Along both of these roads there are many lakes that are used for ice fishing. Some of the most popular along Swanson River Road there are Forest, Breeze, Dolly Varden and Rainbow, and along Swan Lake Road we have Fish, Doghouse, Ice, Canoe, Campfire, Willow, and Paddle. I may have missed a few lakes, but that doesn't mean there are no fish in them—you just never know until you try. Please remember that snowmachine use is prohibited for accessing lakes within the Swanson River and Swan Lake canoe systems, because these areas are set aside for non-motorized uses, such as dog mushing, snowshoeing, and cross-country skiing. All lakes and ponds in the Swanson River drainage have a limit and possession of rainbow trout of five per day, and only one 20 inches or more.

With the beginning of a new year, all anglers 16 years of age or older are required to have on their person a current (2000) fishing license. Fishing licenses purchased in 1999 are no longer valid. Ice fishing with two closely attended lines is legal, provided only one hook or artificial lure is used on each line. The use of live bait is prohibited.

There are special regulations for large rainbow/steelhead trout. The yearly limit for rainbow/steelhead trout harvested in combination from Cook Inlet and its freshwater drainages (north of a line from Cape Douglas to Point Adam) is two trout 20 inches or more in length. Furthermore, all anglers who are sport fishing for rainbow/steelhead trout are required to maintain a current harvest record on the back of their regular sport fishing license, and harvest information should be recorded immediately upon landing a rainbow/steelhead trout 20 inches or more in length.

OK, now that you've caught your fish, here is my favorite recipe for poached trout. (As a law enforcement person, it's hard for me to recommend anything "poached," but this is still a great recipe!)

(Legally-Caught) Poached Trout Recipe

- 1 ½ lb. frozen trout
- 14 oz chicken broth
- 1/4 cup butter, melted
- 1 tbl red wine vinegar
- 4 lemon wedges
- dash garlic powder
- dash pepper

Wash the fish but do not thaw. Wrap in cheese cloth. Combine broth, vinegar, pepper and garlic powder in a pot or skillet and bring to boil. Reduce heat to a simmer and gently lower the wrapped fish into the liquid. Poach, carefully turning after 3 minutes. Cover and poach for an additional five to seven minutes or until flesh flakes easily. Serve with melted butter and lemon wedges. ENJOY!

Mimi Thomas is a law enforcement officer on the Kenai National Wildlife Refuge.

Wildland firefighting in America—a family affair

by Doug Newbould

When it comes to families, I believe I am especially blessed. Not counting the family of man, I am a member of four special families: my immediate family, my extended family, my church family and my firefighting family. In the American branch of the wildfire family tree, I have roughly 30,000 relatives. As with my extended and church families, I don't know all my firefighting relatives. But I do know more people in my fire family than in the other three families combined. The good news about my fire family is that I never feel guilty about failing to keep in touch with any of them. You see, we all know the odds are good we will cross paths again one day, out on the line or in some fire camp.

I guess you could say I was adopted into the American firefighting family almost 25 years ago, just a pup really—a nineteen year old, wet-behind-the-ears college kid. I got my basic fire training on the Bridger-Teton National Forest in northwest Wyoming, during the bicentennial year 1976. I remember cutting my firefighting teeth on a couple of small (less than one acre) duff fires that summer, digging fireline and mopping up. My second summer in Jackson Hole I got a few more fires under my belt, and to my excitement—my first real wildfire.

I have several distinct memories of that first timber fire. It was a remote lightning-caused fire in spruce-fir forest near Afton, Wyoming. We flew into that fire in a helicopter (my first helicopter ride). I was lucky enough to fly in with the Fire Boss (they call them Incident Commanders these days). The Fire Boss wanted to "recon" the fire, so we flew round and round the smoke column until he felt familiar with the fire's environment and its behavior. I'll never forget the exhilaration of looking straight down at a hundred–foot roman candle (a torching spruce tree), as the pilot laid that ship on its side so the Fire Boss could see the action.

I remember chasing spotfires and digging a handline around a spotfire at the base of a tree. I remember finding that same spot again the next day after the main fire had burned over it, and realizing with pride that the line I built to keep the spotfire contained had actually kept the main fire from burning the tree within. I remember when the fire blew up that first shift, and feeling the air I was breathing getting sucked into the inferno at almost 100 miles per hour. And I remember waiting for the helicopter to take us back to civilization, and the Fire Boss telling the helicopter foreman, "Get him outta here" (in reference to me as I lay sprawled on my back—exhausted after a 24-hour shift).

I have fought many wildfires in the twenty-plus years since that time. Some have long since been forgotten. Others I will never forget. The big ones tend to stay with you for a long time—the fire names and locations, the episodes of extreme fire behavior, the unusual experiences, old and new friendships, and especially the fallen comrades. I'll always remember Gallagher Peak in '79, the Chaos and Garden Valley fires in '86, Clover Mist (Yellowstone) in '88, the A-Rock Complex (Yosemite) in '90, and so many others. The most memorable experiences for me are always the hand-crew assignments, as a crew boss or crewmember. Whether the incident lasts three days or three weeks doesn't really matter. When you work side by side with 15-20 other firefighters in extreme conditions, fighting a common foe, there will always be lasting relationships and memories.

Last October I was dispatched to a 130,000-acre fire in northern California, the Big Bar Complex. My assigned position was Felling Boss. A felling boss normally supervises one or more tree felling teams, each team consisting of a sawyer and a swamper (helper). These felling teams usually cut the largest hazard trees (dead trees, burning snags and leaners that threaten firefighters) along fire lines and roads within and around the fire perimeter. The Big Bar was the largest fire in California last year, burning big chunks of the Shasta-Trinity and Six Rivers National Forests and threatening many private homes and the Hoopa Indian Reservation.

My assignment only lasted a week, but I will have some lasting memories: the ancient stand of Douglas-fir at Groves Prairie, the Trinity River gorge near Burnt Ranch, and the distant roar of the crown fire that consumed thousands of acres of forest in the Tish Tang a Tang drainage in a matter of minutes.

But my favorite memories from Big Bar will be of my family, both old: "sister" Traci who I had not seen since Yellowstone in '88, "uncle" Mike from my years working on the White River National Forest in Colorado, and "cousin" Dave from the Midnight Sun Hotshots in Alaska; and new: "brothers" Tommy from Virginia and Dave from Cecilville, CA, and "cousin" Joe the guitar wizard from Eureka, CA...until we meet again!

Doug Newbould is a fire management officer at the Kenai National Wildlife Refuge. For more information about the refuge, stop by headquarters on Ski Hill Road in Soldotna, call 262-7021, or visit our website at http://www.fws.gov/refuge/kenai/.

Are we cooling down, after all?

by Ed Berg

There has been a flurry of articles in the press recently about the climate in the North Pacific starting to cool down. Is there any basis for this? And what happened to "global warming?" In the 1980's and 1990's we have grown quite fond of warmer summers and milder winters in southern Alaska. Are we about to lose our "Banana Belt" status?

There is indeed cause for concern, if you are overstocked with shorts and sandals. Here is what's new: climatologists have recently compiled a 100-year record of North Pacific sea surface temperatures. This record shows a strong 20-30 year warm and cool cycle, which has been dubbed the "Pacific Decadal Oscillation" or PDO. Our present warm cycle began in 1977. There was a warm cycle from 1926 to 1946, and a cool cycle from 1947 to 1976.

Kenai and Homer, being coastal communities, track these sea surface temperatures very closely, with correlations of 75% and 82%, respectively. In 1998 and 1999 the PDO took a down turn, as did Kenai and Homer temperatures, especially in 1999. Last year was cold in early months (e.g., February), and cold in late months. So, it comes down to this: have we turned a corner in this 20-30 year cycle, and are we now two years into the cool phase? If we knew the basic mechanics of ocean currents and water temperatures, we could give a clear yes or no to this question. We do know that ocean temperatures have a profound effect on weather, but at this point we don't understand what makes ocean currents (and temperatures) change from year to year. Satellite imagery, however, now produces remarkable temperature "photographs" of the oceans, which can be tracked from year to year.

We may not know the mechanism of temperature change, but can we make some reasonable predictions, based on past performance? I think we can, to the same degree that stock market analysts make predictions about stock prices. There are two approaches to predicting stock prices: one approach looks at the "fundamentals"—is the company financially solid, with good management, good credit, a good position on the industry, etc.? The other approach ("technical analysis") ignores the fundamentals and simply looks at the trend of the stock price. Is the stock going up or going down? The technical analysts try to buy on the way up and sell just as the price turns and starts to go down.

With long-term climate prediction we don't know the "fundamentals," so we have to fall back on "technical analysis," which is basically a matter of judging the trend (either by eye or with statistical aids). When I look at the 100-year PDO graph I see a strong 20-30 year cycle, and I see that we are now 23 years past the 1977 upturn. To me, "OVERDUE!" is flashing in yellow lights (at least) on this graph—it's time for a downturn. A skeptic, however, can look at the same graph, and say "Nope, we've got ten more years of warm weather left." So, it will take a few more years to see if the downturn is real.

I also see a lot of short term "noise" on the PDO graph—temperature ups and downs in 2-3 year periods. These are El Niño/La Niña warm and cool cycles, which are caused by warm and cold ocean temperatures off the west coast of South America. The long-term PDO cycle is like an El Niño/La Niña stretched out over 20-30 years: the PDO is the bass note and El Niño/La Niña is the treble, one might say.

There is a practical side of the PDO vs. El Niño/La Niña time scale, if you depend on commercial fishing in any way. Salmon returns appear to follow the PDO, just like annual temperatures on the Kenai. Alaska salmon returns were at historic highs in most of the 1977-1997 period. One could well argue that the recent weak returns in Bristol Bay are a strong indication that we are into a PDO cool phase, and that salmon returns in Alaska will be generally down for the next 20-30 years.

From the 1977 PDO warming, biologists have learned that sea surface temperatures changes can have a major effect on many marine organisms (a "regime shift," so to speak). In the years following 1977 some populations (or at least their harvest) increased: Gulf of Alaska halibut and flounder; central and western Alaska chinook, chum, coho, pink, and sockeye; eastern Bering Sea herring, rock sole and flathead sole. Other species decreased: Gulf of Alaska shrimp, and recruitment of eastern Bering Sea yellowfin sole, turbot, plaice and perch.

The temperature effect on fish may be more through their food chains than direct physiological effects. For example, warm years increase surface streamflows (like the Kenai River) which enhances juvenile salmon survival, as well as near-shore mixed layer conditions for phytoplankton and zooplankton. Warm years can also affect wind patterns and change the upwelling of nutrients,

Since the PDO took a major dive in 1999, it is quite possible that some of the above-mentioned fisheries may soon reverse themselves. Federal marine biologists Paul Anderson and John Piatt have recently described the crash of Kodiak shrimp after water temperatures rose in 1977 from 0-2℃ to 4℃ (and the subsequent rise of salmon, pollock and flatfish). Water temperatures are now falling, and the biologists predict the return of Kodiak shrimp, and also of capeline, a fatty forage fish utilized by seabirds and marine mammals.

There is a lot of information on the Internet about the PDO and its ecological implications:

Last week PDO founders Steven Hare (North Pacific Halibut Commission) and Nathan Mantua (University of Washington) put an important review paper on their website http://www.iphc.washington.edu/Staff/hare/html/papers/EI/abst_ei.html, which provided much of the information above.

Recent news articles are available at http://www.iphc.washington.edu/Staff/hare/html/pdo/pdopress.html.

A dramatic color movie of satellite pictures of Pacific Ocean temperatures can be viewed at http://topex-www.jpl.nasa.gov/elnino_mov/index.html.

Ed Berg has been an ecologist at the Kenai National Wildlife Refuge since 1993. Previous Refuge Notebook columns can be viewed on the Web at http://www.fws.gov/refuge/kenai/.

Saying goodbye

by Robin West

The February 25-26 edition of the *Clarion* printed an excellent obituary for long-time Alaskan David L. Spencer. Dave died on February 9th of this year at the age of 84. Dave was more than an Alaskan pioneer was; he was also a personal hero and a friend. It will be hard to say good-bye.

The Kenai National Moose Range was created in 1941, only a few days after Pearl Harbor was bombed. As the Country went to war, national priorities precluded the timely staffing of the new Refuge. Dave enlisted in the U.S. Navy in 1942 and became a naval aviator and flight instructor, teaching new pilots to fly multi-engine amphibious aircraft. The flying skills Dave acquired in the military, complimented by conservation training from some of the nation's best, including Aldo Leopold, uniquely qualified Dave to be the first Refuge Manager at Kenai. He left his position as a flyway pilot biologist in the Everglades National Wildlife Refuge (later to become a National Park), arrived at his new post in Kenai in 1948 and began in earnest the work at hand.

Although there were 14 National Wildlife Refuges in the Alaska Territory in 1948, some dating back to the early 1900's, Dave was only the second manager appointed anywhere in the Territory. Equipment, facilities, and staff were absent and Dave pieced together the early refuge management program by innovation and hard work. Since he was one of a very small cadre of Territorial wildlife professionals, work often took him to other places in Alaska, such as the Yukon Delta, Kodiak, and the Aleutian Islands.

I enjoy looking back over the old reports, one submitted by Dave in 1949, which described supplementing log structures with surplus military Quonset huts, development of an economic use plan, law enforcement patrols, fire planning and training, sealing of beaver hides, Cook Inlet waterfowl surveys, surveying moose on the Kenai Peninsula and elk on Afognak Island, and providing information to the public.

Dave and wife Eloise homesteaded near Beaver Creek where they raised their family and lived until transferred to Anchorage in 1968. Life in the early years was much different than now: fewer people, different values, and a different pace to life. When Dave first arrived in the area, there was no road from Anchorage to the Kenai Peninsula. A typical day for Dave began with him using a hand pump to fill two 50 gallon water barrels on the second story of his partially plumbed home.

Dave Spencer had vision. He was the single most responsible person that shaped the National Wildlife Refuge System that exists in Alaska today. He fought tirelessly to preserve the refuge lands for wildlife, fisheries, and public use. He led the refuge planning effort which designated the Andy Simons Research Natural Area that eventually became the Andy Simons Unit of the Kenai Wilderness Area within the refuge. Andy was a well-respected guide who operated early last century on the Kenai Peninsula, and provided an early voice for setting aside of some of the nation's finest wild lands for wildlife and wildlife-dependent recreation.

Dave also worked to establish the Swanson River and Swan Lake Canoe Routes. These areas later became the Canoe Lakes Unit of the Kenai Wilderness Area. In 1997 the area was re-named in honor of Dave as the Dave Spencer Unit of the Kenai Wilderness Area.

Dave spent 26 of his 34 years of federal service in Alaska. After managing the Kenai Refuge, Dave served as the regional supervisor for all Alaskan refuges. During this tenure Dave helped add Arctic, Cape Newenham, Clarence Rhode, Izembek, and Simeonof Refuges to the National Wildlife Refuge System.

Stories about Dave abound. One of my favorites involves Dave lassoing a mountain goat swimming in Cooper Lake and, after sheathing the animal's horns with pieces of garden hose and securing it with ropes, flew it to Kodiak Island as part of a transplant effort.

Another great story illustrates Dave's innovation and leadership, when the integrity of the Russian River fishery was threatened by a naturally forming diversion in the headwaters. Without action, the Russian River would have been regularly filled with glacier silt that would have destroyed the fishery. Dave, with the help of several other adventurous types, worked to get a surplus D-7 Cat into the area and built a dam to keep the Skilak Glacier run-off going into the Resurrection

River rather than into Upper Russian Lake. Dave is now gone, but the old Cat and earthen dam remain there today, nearly four and half decades later as a testament to men who did what it took to get the job done.

I have said good-bye to Dave, but I know that I will never forget him. His past work has not only made my current job easier, it has helped assure a quality of life for Alaskans well into the future.

Robin West is the current manager of the Kenai National Wildlife Refuge. Previous Refuge Notebook columns can be viewed on the web at http://www.fws.gov/refuge/kenai/.

Kenai Refuge partners

by Bill Kent

I recently reflected on how many agencies, organizations, and individuals the Kenai National Wildlife Refuge interacts with, and how each of these interactions might be considered a partnership. Some of these partnerships are very formal, with written agreements signed at high levels; others are informal verbal agreements sealed with a handshake, and many fall somewhere in between. Without these partnerships, it would be extremely difficult for us to do our work. Let me give some examples.

Not surprisingly, we partner daily with the Alaska Department of Fish and Game (ADF&G) on a variety of projects, both large and small. Wildlife management on the Kenai Refuge, and the remainder of the Kenai Peninsula is a huge task, and we routinely share information, equipment, and aircraft with ADF&G. We also partner with the Chugach National Forest, Kenai Fjords National Park, and Alaska State Parks, because we share many miles of boundary with these agencies, and wild critters have a way of ignoring human boundaries.

The Chugach National Forest and the Alaska Division of Forestry are partners when we use fire as a management tool, or when a wildfire erupts. Additionally, we have worked with these agencies on the spruce bark beetle issue. Certainly, Central Emergency Services is also a fire partner.

We partner with many non-government organizations such as the Student Conservation Association, whose blue-shirted volunteers are essential to our visitor services programs, and the Alaska Natural History Association, which supports our educational programs through sales at the our bookstore. The Alaska Flyfishers' annual upper Kenai River cleanup is a great help after a busy fishing season. The Nature Conservancy has purchased lands for protection of brown bear habitat near the Refuge, and Anchorage Audubon Society members help in the spring with breeding bird surveys.

The partner list also includes colleges and universities across the country (especially the University of Alaska and Alaska Pacific University) which send graduate and undergraduate students to the refuge for research projects. The education list would not be complete without the Kenai Borough schools, private schools, and home schoolers whose students use the refuge as an outdoor classroom. We also have the Boy and Girl Scouts as partners; there are many scouting projects and activities conducted each year on Refuge lands.

The Kenaitze Tribe has cooperated on a variety of projects, including a recent effort to protect a cultural site at the confluence of Hidden Creek and the Kenai River. Alaska Recreation Management, Inc. is our contractor for the Russian River Ferry, and has provided a great deal of assistance with other aspects of Refuge management. (Speaking of the Russian River Ferry, the Kenai River Sportfishing Association, Inc. recently agreed to assist us with replacing the aging ferry dock.)

And then there are the businesses where we obtain equipment and supplies. Even though they are paid money, without that "partnership," our daily operations would grind to a halt. It has been my personal experience that the retailers on the Peninsula are always willing to help out by checking on the best deal and/or product for our projects. In these days of declining budgets, that extra effort for us is greatly appreciated.

Last to be mentioned, but emphatically the most important, is YOU…each and every one of you who use refuge land and facilities, who call us on the phone or write to us. You are partners with us and help refuge management whether you realize it or not. When you pick up some litter around your campsite, or let us know about an interesting wildlife sighting, or let us know when you see someone violating refuge or state regulations, you are lending a hand to the refuge. We appreciate your help, because without you, our task would be a whole lot tougher. Many thanks!

Bill Kent has been the Supervisory Park Ranger at Kenai Refuge since 1991. His wife Lisa is a pre-school teacher, and their daughter Riley attends SOHI. Previous Refuge Notebook columns can be viewed on the web at http://www.fws.gov/refuge/kenai/.

Be careful; Kenai Peninsula wildlife rife with parasites

by Liz Jozwiak

I've been thinking about writing an article about parasites since I attended a wolf trapping school a few years back. A highly skilled wolf trapper was showing us the proper method for skinning a wolf, and I noticed he wasn't wearing any gloves! All I could think about was the myriad of parasites to which this fellow was unknowingly exposing himself.

As one who handles many species of wild animals (both dead and alive, injured and healthy) inside our laboratory and outside in the field while conducting surveys, I am genuinely fascinated with the variety of parasites that inhabit the wildlife in our region. Most of us know that our pets (cats, dogs, birds…) are susceptible to parasites such as fleas, ticks, lice, or worms, but how knowledgeable are we about the parasites carried by local wildlife?

Many hunters and trappers have little knowledge about the variety of wildlife parasites and diseases, unless they've spent time studying parasitology or microbiology.

Some wildlife parasites are communicable to humans and some are not. For example, several ectoparasites (those that live on the outside of the body) are species-specific; that is, they can live only on a related group of animals such as canids (dog family) or felids (cat family). Dog owners and wolf trappers are familiar with the biting dog louse (*Trichodectes canis*). This species of louse will not survive on man, but it can be transmitted through social contact between dogs, coyote and wolves. It's believed that wolves on the Kenai Peninsula picked up this parasite in the early 1980's through contact with free roaming domestic dogs or coyotes. Heavy infestation of biting dog lice creates a scruffy appearance of the hair coat from scratching and rubbing of the infested areas. In severe cases, patches of hair are missing, which greatly reduces the value of the pelt.

Other examples of ectoparasites that live solely on a host species are the occasional fleas we find on red-backed voles (yes, there are fleas in Alaska!). If they manage to get on you, don't worry; they won't survive more than a few hours. The same goes for fleas on lynx, or lice on eagles. On several occasions I've had to hold down a sick eagle while the lice were slowly making their wayward journey up my arms. They don't live long after they leave their hosts.

One internal parasite that has been found in wolves on the Kenai Peninsula is the tapeworm *Echinococcus granulosus*. This tapeworm has a two-host life cycle, primarily in canids and moose, and rarely in humans. Adult tapeworms mature in the intestine of a wolf or other canid (called the "definitive host") and the eggs are released into the feces. The eggs enter an intermediate host (such as moose or caribou) by ingestion of feces-contaminated vegetation. The eggs hatch into larvae (small worms) in the intestines of the intermediate host and travel through the lymphatic or blood system throughout the body where they lodge within the body tissue and develop into fluid filled cysts (hydatids). Upon the death of the intermediate host (such as a moose), either through direct predation by wolves, or scavenging by coyotes on the carcass, the larvae are transmitted back to a definitive host, where they develop into adult tapeworms and the cycle begins anew.

Echinococcus can have many intermediate warm-blooded hosts, such as humans, sheep, horses, and cattle, as well as moose and caribou. Humans, especially children, acquire *Echinococcus* in the same way as other intermediate hosts, i.e., by ingestion of *Echinococcus* eggs. This usually occurs by hand-to-mouth contact with infected dogs or their feces. Humans infected with *Echinococcus* usually develop masses of hydatid cysts on the liver, lungs, or stomach cavity. As long as the cysts do not develop in a high-risk area of the body, such as the brain, the mass can be surgically removed, and is usually not life threatening. In Alaska there are only a handful of cases of humans contracting *Echinococcus* (also known as hydatid disease), primarily through exposure of their dogs to raw moose or caribou viscera, and subsequent contact with their infected dog. Hydatid disease is most prevalent in the sheep-raising regions in the western states.

The best way to avoid contracting *Echinococcus* is good hygiene. Wash your hands after you skin that wolf or coyote, and avoid contact with their feces. Better yet, use a pair of disposable rubber gloves. People often break open dried coyote and wolf scats to see

what the animal has eaten, as revealed by bits of bone, teeth, and hair. This is interesting to do, and it can be done with a sharp stick or rubber gloves, but don't do it with bare fingers!

Keep in mind that the eggs of *Echinococcus* can remain dormant in below freezing temperatures for up to 1 year. To reduce the chance of exposing your pet to this tapeworm, don't let your dog feed on raw moose entrails or gut piles. By exercising caution, you can reduce the risk of your family becoming the next generation of "intermediate hosts."

Liz Jozwiak is a wildlife biologist at the Kenai National Wildlife Refuge in Soldotna. Her recent focus has been studying the Kenai wolf population. She is also a fastidious hand washer. Previous Refuge Notebook columns can be viewed on the Internet at http://www.fws.gov/refuge/kenai/.

We're gearing up for fire season 2000. Are you FireWise?

by Doug Newbould

Well, it's that time again. The hours of daylight once again exceed the hours of darkness, the mercury is rising slowly towards "tee-shirt weather," and the dog's footprints are more noticeable on the floor. Fire season can only be just around the corner. I know it doesn't seem that way, when you look out your window at the new snow on your car and those old snow berms along the driveway. But it's true.

The traditional first day of the wildland fire season here in the Cook Inlet area is the 15th of April, a date that signifies many different things (mostly unpleasant) to Americans. As a fire management officer and firefighter, the approach of that date means I need to be ready. Personally, I need to be physically and mentally prepared for the rigors of a six-month fire season. I'm finding the physical part is more and more difficult every year! Professionally, I need to ensure that the Kenai National Wildlife Refuge is ready for the fire season by hiring seasonal firefighters, ordering supplies, checking equipment and getting everybody trained.

I'll have to admit I am not as far along in my preparations as I would like to be at this time of year, but I believe the Refuge fire staff will be ready when the snow finally disappears. How about you? Have you developed a FireWise action plan for your home or business? Have you begun to implement your plan?

If you are one of those folks who know what I'm talking about, this will serve as a friendly reminder to get busy—BEFORE the snow disappears. If you don't have the slightest idea what I am talking about, you might be someone who rarely reads the paper or listens to radio, you may have recently moved here, or perhaps you have a very selective mind that filters out seemingly useless information (my wife often accuses me of filtering out the things she tells me).

If you are among the latter group, I want to tell you about the basic elements of the FireWise Community Action Program and where you can get a free kit for your home or business. Each kit contains a risk analysis for homes (or businesses) in the wildland/urban interface and six pamphlets describing the basic elements of a FireWise Plan.

The first phase of the FireWise program is to assess your home or business for the risks of damage or destruction from a wildfire. From the assessment, you can identify any deficiencies or needed improvements for your home and property. The second phase of the program develops a plan for making the necessary improvements. All of the "tools" in the FireWise kits are easy to use, and there are many improvements you can make at little or no cost.

The six elements of the FireWise Plan are:

1. Develop and Maintain a FireWise Landscape Around Your Home (to reduce the size and intensity of a wildfire approaching your property by altering the vegetative fuels),
2. Make Sure Emergency Personnel Can Locate and Get to Your Home (with clearly marked signs and/or landmarks and adequate road access),
3. Establish Your Emergency Water Supply (maintain an adequate water supply during a power outage or periods of high demand),
4. Build or Remodel to Make Your Home Resistant to Fire (your home and other structures should be able to survive a wildfire independently of fire suppression agency presence),
5. Fire Safety Inside Your Home (ensure life safety for all family members), and
6. When Wildland Fire Threatens (planning your responses before an emergency to avoid panic and confusion).

You can get a FireWise kit at the local fire station, at the Alaska Division of Forestry office in Soldotna, at Refuge Headquarters on Ski Hill Road in Soldotna, or at the Home Show at the Peninsula Sports Center on April 29-30.

Wildfires in Alaska can be very scary, especially in dry weather, and FireWise preparation can reduce the fear factor. Spring seems to starting early this year, and the forests can potentially become quite dry in April and May before the grass greens up and the trees leaf out. I'll admit that it is tempting to burn

slash and trash in the spring when the snow disappears, but this can be the most dangerous time of year for escaped fires. Readers may recall that Homer's Hutler-Mansfield Road fire last June was an escaped slash burn. Burn permits are required for any kind of open burning after April 15th, and can be obtained by calling the Alaska Division of Forestry office at 262-4124 in Soldotna.

Doug Newbould is a fire management officer at the Kenai National Wildlife Refuge. For more information about the Refuge, stop by Headquarters at the top of Ski Hill Road in Soldotna, call (907) 262-7021 or visit our website at http://www.fws.gov/refuge/kenai/.

Helping one sick eagle: A difficult and risky task?

by Ted Bailey

Ever wonder what happens after you report a sick or injured bald eagle to a wildlife agency on the upper Kenai Peninsula? Regardless of who you reported it to, someone at the Kenai National Wildlife Refuge, and then at the Richard's Veterinary Clinic will likely respond to the call. It's a federal job, because bald eagles and other migratory birds that regularly fly across state boundaries need the broad protection of federal laws.

A few weeks ago we received a typical call about a sick eagle at the Borough landfill in Soldotna. Because of their scavenging lifestyle, eagles are attracted to the landfill where they not only find human food but also expose themselves to a variety of health risks. We have made numerous trips to the landfill to respond to sick or injured birds. As often happens, it was on a Saturday afternoon. Reports of injured bald eagles occur mainly on weekends, evenings, or holidays, because more people are outdoors at these times. We receive few sick eagle calls during normal business hours on weekdays.

Wildlife biologist Rick Ernst responded to this particular call during his weekend off; he retrieved the lethargic eagle, and took it to Richard's Veterinary Clinic. There, in the evening hours after the Clinic was closed, veterinarian Dr. Bart Richards examined the eagle, cleaned off an unknown repulsive-smelling residue, and held the bird overnight. During handling, the eagle regurgitated a large chunk of animal remains and slowly began to improve. We will send off the remains for analysis because we suspect some form of poisoning.

By Sunday the eagle had recovered enough to be moved from the Clinic, but Rick Ernst was leaving on a trip and asked me to take over. I told the Clinic that I would retrieve the eagle and hold it in our eagle flight pen for observation before releasing it. In the meantime I searched through our home freezer for some salmon to thaw out for the eagle.

Handling a mature bald eagle is not without its risks, because their sharp talons and strong beaks are formidable and fast-moving weapons. Although Dr. Richards has handled numerous eagles under similar circumstances, this particular eagle managed to twist and bite his hand before we transferred it into a portable kennel. Such bites are not only painful; they can be potentially serious. We did not know the cause of the bird's illness, nor did we know what human-related disease agents it might have picked up in the landfill.

Back at the Refuge, after a trek through deep snow, I discovered that our eagle flight pen was unusable because the heavy winter snow had collapsed the fishnet roof and sides of the pen. I then took the eagle to a smaller steel cage in our lab at Refuge headquarters. The bird was comfortable there, but for the next two days it refused to eat anything. We dangled salmon in front of its beak and left salmon in the cage, but it never touched it.

I was concerned that food deprivation and dehydration might weaken the eagle if we did not feed and release it soon. With this in mind, I and two staff members, Stephanie Rickabaugh and Bob Schulmeister, set about to force feed the eagle some salmon on Tuesday morning. I reached into the cage with a net, and grabbed the legs to immobilize the talons. Bob held the wings and head, and Stephanie used lab tongs to gently force bite-sized pieces of salmon down the gullet until it had no option but to swallow. During this process, the eagle managed to twist and bite yet another hand. After force feeding, we put it back into the portable kennel, and Stephanie released it on the Refuge far from the landfill. She reported that it promptly took off, perched temporarily in a nearby tree, then took off again, circled high and disappeared over the horizon.

So, here are the benefits and costs of one report of a sick eagle: on the benefit side, we have one bald eagle recovered and released back into the wild. On the cost side, we are down some salmon from a personal food supply, we had unexpected telephone calls during a weekend that required changed personal plans for two refuge wildlife biologists and a veterinarian. And we have two people dedicated to wildlife conservation with bite wounds, wondering and hoping that the eagle has not inadvertently passed on to them something dreadful.

The Refuge's response to calls of injured or sick bald eagles may vary, but this case is not atypical, ex-

cept perhaps for the bites. Most eagles do not bite when handled, but they can be nasty with their talons. Handling any live bald eagle is not done without some risk. Furthermore, we have to coordinate responses to sick or injured wildlife with other Refuge activities, and we aren't always able to drop everything else in order to respond to an injured wildlife call. Richard's Veterinary Clinic has volunteered for the Refuge for over 15 years, without charge, to help sick and injured bald eagles and other birds and wildlife on the Kenai Peninsula. This has been an outstanding contribution, and all friends of wildlife owe them a vote of thanks!

Ted Bailey, a supervisory wildlife biologist, has been responsible for the Kenai National Wildlife Refuge's biological programs for over 20 years. He and his staff monitor and conduct studies on a variety of refuge wildlife populations. Previous Refuge Notebook columns can be viewed at http://www.fws.gov/refuge/kenai/.

Kenai Wilderness: The cornerstone of wildlife conservation on the Kenai Peninsula

by Rick Johnston

Here on the Kenai, if you've visited the Russian River falls, caught a Russian River red or an early run king, fished commercially, harvested a trophy bull moose, or held your breath at the sight of Brown bear, you're are reaping the benefits of Wilderness protection. Like shrewd investors who have protected their nest egg for hard times, Kenai Peninsula residents have a rich bank account of tangible fish and wildlife benefits as a result of the foresight of those who spent years working for Wilderness protection for the Kenai.

Wilderness…to some the word has almost prayer-like connotations…to others it represents too much federal land protection and an unnecessary substitution of distant federal decision-making over local wisdom and tradition. Even many wildlife managers have historically seen Wilderness protection as an impediment to good management. Others, however, like myself, see Wilderness as the only lasting protection for wildlife dependent on large home ranges and vulnerable to human activities.

I find it odd that the definition of "wilderness" in the Wilderness Act of 1964 did not specifically mention wildlife, but focused only on human impacts:

> A wilderness in contrast with those areas where man and his own works dominate the landscape is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act an area of undeveloped federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions…

It was some years after the 1964 Wilderness Act that people began to appreciate federal Wilderness as protected habitat for wildlife, when human population and urban sprawl began to compete more aggressively with wildlife for undeveloped lands. This theme was first hammered home by wildlife advocate Hank Fisher to a large group of resource managers at the First American Wilderness Management Conference at the University of Idaho in 1983. Striking a Winston Churchill pose, Mr. Fisher announced, Wilderness is good for wildlife!, and like Churchill, he proceeded to repeat this utterance eye-to-eye to various members of the audience, until they began to squirm. To this day I'm sure that no one present has ever forgotten his point!

Hank Fisher's point, simply translated, was that all things considered, federal Wilderness protection was the single most important cornerstone of wildlife protection in the United States.

One might think Mr. Fisher was preaching to the choir, considering the hundreds of federal land managers, biologists, and academics in attendance. To the contrary, however, many forest and wildlife managers had resource husbandry backgrounds; they considered Wilderness protection more of an "outdoor recreation" benefit rather than a preferred wildlife management tool. Many had spent their careers working to restore heavily grazed and cutover lands in the Lower-48, and the idea of preserving pristine lands for wildlife (rather than for human enjoyment) was beyond the scope of their professional experience.

Alaskans, however, knew real wilderness, and knew its value for wildlife. One of the first Wilderness Areas within the National Wildlife Refuge System was Chisik Island—that island geologic upheaval across from Ninilchik at the mouth of Tuxedni Bay. Tuxedni Wilderness encompasses most of Chisik Island and was established in 1967, and tens of thousands of nesting sea birds call Tuxedni Wilderness home each spring.

Support for federal Wilderness in Alaska had its roots on the Kenai Peninsula much earlier at the Kenai National Moose Range, as the Kenai Refuge was originally called. The Kenai National Moose Range was one of the first places in Alaska where wildlife and habitat protection came face-to-face with oil and gas development, community expansion, and road construction.

Seeing oil and gas development throughout the 1950's, as well as withdrawal of Refuge lands for homesteading, Refuge Manager Dave Spencer became concerned about loss of habitat for free roaming wildlife on the Kenai National Moose Range.

In the late 1950's, invoking the name of master guide Andrew Simons who was a strong supporter of wildlands, Dave Spencer established the Andrew Simons Research Natural Area between Skilak and Tustumena Lakes. The 806,000-acre area was chosen to protect salmon and brown bears and their habitat, and it was closed to all oil and gas exploration and leasing.

Later, the Wilderness Act of 1964 established Wilderness Areas and called for a systematic inventory of all federal land within existing National Forests and National Wildlife Refuges. The Kenai National Moose Range lands were inventoried and studied in the late 1960's and early 1970's with much public input. The Andrew Simons Research Natural Area became the core of several wilderness proposals which also included the Swan Lake and Swanson River Canoe route areas, the Caribou Hills, and the Mystery Hills. However, after getting caught up in debate regarding federal lands throughout Alaska, it wasn't until 1980 that Congress acted on the Kenai's proposals. As a provision of the Alaska National Interest Lands Conservation Act (ANILCA), the Kenai Wilderness Area was established, with considerably more acreage than the Refuge originally proposed. Underscoring the importance of fisheries protection, Congress added all of Tustumena Lake's 72,000 acres to the final Wilderness designation.

The Kenai Refuge presently has 1,315,809 acres of Wilderness, which represents 69% of the Refuge's almost 2 million acres. We have proposed (in 1988) classifying an additional 192,000 acres in the Chickaloon Flats—Big Indian Creek area as Wilderness, but it could be years before Congress acts on this proposal.

Although there has always been spirited debate regarding Wilderness protection on the Kenai National Wildlife Refuge, the early hunting guides, fish and game advisory committees, homesteaders, Refuge managers, and long-time Kenai Peninsula residents provided the support that ultimately resulted in Wilderness protection. In many ways they foresaw the simple truth spoken by Hank Fisher at the 1983 Idaho conference…that Wilderness is indeed good for wildlife, and that protecting large ecosystems was ultimately the only way to insure a continuing legacy of wildlife on the Kenai.

Rick Johnston is a Ranger/ Pilot for the Kenai National Wildlife Refuge. Previous Refuge Notebook columns can be viewed on the Web at http://www.fws.gov/refuge/kenai/.

Spring edible plants are arriving

by Ed Berg

Tasty edible plants are one of the things I like best about the arrival of spring. I've already enjoyed the first steamed Nettles from the shores of Kachemak Bay, and I'll be gathering more tender young nettles during the next few weeks. They are in the red stage now, but they will soon be turning green.

Many people wince at the thought of eating Nettles, imagining their mouth on fire from the tiny stinging hairs that cover the plant's leaves and stems. Nettles do indeed need to be disarmed, but this is a simple matter. I always wear gloves to collect nettles, then I steam them with a steaming basket. A couple of minutes of heat completely breaks down the inflammatory ingredient and makes the delicious nutty flavor painlessly available. Some folks dry their Nettles on a rack and use them to thicken soups. Drying like steaming also takes out the sting.

Wild Cucumber is another early spring favorite. Later in the season it's called Watermelon Berry or Twisted Stalk, but in early spring the juicy cucumber flavor seems to provide the logical name. The young stems are rather weak and often bend under the weight of the new leaves; this droopy look is an eye-catching trait when it the shoots first appear. Wild Cucumber is an entirely benign plant and children are known to eat the stems (and later the watery berries) in large quantities.

Speaking of children, a fieldtrip for wild edibles is one of the best ways to get the kids out in the woods in the spring. Kids generally love anything to do with eating! For many years I accompanied the Homer 4th graders to China Poot Bay for Sea Week in the spring, and our edible plant hikes were always a big hit. At this time of year, leaf buds appear on the spiny Devils Club bushes. When these buds are less than inch long, they are easily broken off and are fun to munch as you walk through the woods.

One of the 4th graders' favorite collecting sites was a small bog, where with careful searching they could find last year's berries. Black Crowberries and Lowbush Cranberries (Lingonberries) survive the winter well and are easily spotted. Harder to find but tastier are the Bog Cranberries (True Cranberries) which have thread-like stems and tiny leaves. The plump 1/4" berries seem much oversized for the almost invisible stems, but this plant puts almost all of its resources into reproduction.

Fireweed shoots will be appearing in the next few weeks. These are best eaten while they are still red and less than 4" long. The abundant upright red stems are hard to miss, and can't be confused with any other native plants at this stage. Like many wild plants Fireweed becomes bitter later in the season as part of its chemical defenses. If you are a plant, it is to your advantage not to be eaten. Most plants have evolved Aanti-herbivory chemicals that make them taste bad or toxic to whoever might eat them. The flavors of the spices enjoyed by humans have evolved over millions of years to prevent critters (such as insects, birds, rabbits, moose, etc.) from eating those plants. Critters however are always evolving counter-measures for breaking down these chemical defenses. Thus we see the well-adapted moose happily eating just about every kind of shrub that we would ever care to plant, regardless of how bad we might think these shrubs taste.

Humans have handled plant chemical warfare by cultivating only the most bland and mild-flavored plants (iceberg lettuce being the extreme case), but this has been at the cost of a reduction of vitamin and mineral value, according to nutritionists.

People sometimes complain that wild plants (i.e., vegetables, not berries) have stronger flavors than they are used to eating. My solution to this is plenty of vinegar-and-oil salad dressing. A spring salad of Fireweed shoots, Wild Cucumber, and Cardamine (with its peppery taste), spiked with sliced tomatoes, and well-dressed with vinegar-and-oil is hard to beat at any price. Of course, some feta cheese and olives never hurt, and I like to add some anchovies!

After the Nettles and Fireweed, we should soon see Fiddlehead Ferns, Dandelions, Clover, Violets, Chickweed, Monkey Flower, and Jewelweed—all great salad herbs, when young.

There is indeed much to eat at this time of year, but some care is needed; you should never eat a plant that you don't know. Children can easily learn to identify the common plants mentioned above, but they

should also learn to identify the few toxic ones such as Baneberry, Poison Hemlock, False Hellebore, Monkshood, and Lupine. Children too should be warned about handling fresh Cow Parsnip (Pushki) stems and foliage, because the oils make some people's skin very sensitive to sunlight and blistering sunburn. This being said, the vast majority of plants on the Kenai Peninsula are either harmless or downright tasty, and it's easy to avoid the troublemakers.

Care should be taken to not overpick the wild plants at a given site. Many critters—including two-legged ones—will be foraging here in the future, and they should all be able to enjoy nature's bounty.

At the Kenai Refuge bookstore we sell two excellent guidebooks on edible plants. For pocketsize and price, the Co-op Extension's *Wild Edible and Poisonous Plants of Alaska* is the classic at $4.95. For more details, beautiful photos, and medicinal applications the best of its kind is Jan Schofield's *Discovering Wild Plants: Alaska, Western Canada, the Northwest* at $34.95.

Ed Berg has been the ecologist at the Kenai National Wildlife Refuge since 1993. Previous Refuge Notebook columns are on the Web at http://www.fws.gov/refuge/kenai/.

Wood frogs calling—a sure sign of spring

by Ted Bailey

If you live near a small pond or bog surrounded by forest on the Kenai Peninsula, you may have been hearing some mysterious sounds in the late evenings this past week. Some say these sounds remind them of birds, others compare them to a group of noisy ducks. The makers of these "clacking" spring sounds are difficult to see unless you are intent on discovering their source. Usually the calls stop before you can get close to the edge of the pond. However, if you are patient a small creature will pop to the water's surface and you will be rewarded to see the Kenai Peninsula's only amphibian—the wood frog.

Wood frogs began calling in a pond near our home last weekend, and breeding should reach a peak during the first two weeks of May. The snow and ice has barely melted from the pond and some snow remains around the pond's margin. It is not unusual for wood frogs to begin breeding before ponds are entirely ice-free. At the peak of their breeding season, the calls of wood frogs can be heard during the middle of the day. Male frogs, which are smaller than females, make the "clacking" calls to attract females to the breeding ponds. Egg laying begins soon after the females arrive.

Eggs from each female are laid in a gelatinous mass about the diameter of a quarter. This egg mass soon expands by absorbing water to reach the diameter of a tennis ball or baseball. Wood frogs are communal breeders. Pairs of breeding wood frogs do not disperse their egg masses randomly around a pond's margin. Instead, many frogs congregate together, and often nearly all the eggs in a pond will be deposited in only one or two small areas. They may place more than a hundred egg masses together within an area of only several square feet. Each egg mass is typically attached to a stem of grass or a small shrub. Within this egg mass are hundreds of separate eggs, each surrounded by its own protective membrane.

Hatching time is dependent on water temperature. In time the eggs develop into tiny tadpoles which break through the surrounding membrane and enter the pond to feed on microscopic food. If they are lucky and the pond does not dry up, they will grow into tiny frogs before the pond freezes over.

The calls of wood frogs can also be heard throughout May on larger lakes, as these lakes become ice-free and their water temperatures rise. The larger lakes are often the last places to be used by breeding wood frogs and may be avoided if smaller nearby ponds are available. Although large lakes provide stable water levels, they are dangerous places for wood frogs to deposit eggs. Large lakes are more subject to wind action, and waves can tear the egg masses from the shoreline vegetation and destroy them. Many large lakes also support fish that prey on frog eggs or tadpoles. That is why small, shallow ponds whose margins are lined with aquatic plants are preferred breeding sites. Water temperatures in small ponds rise quickly in the spring, and the tadpoles are safer from predators.

This should be a good breeding year for wood frogs because of last winter's high snowfall; abundant meltwater has filled many small ponds and muskegs. Small shallow ponds have been shrinking and many have dried up completely on the Kenai Peninsula over the past five years. Thus there have been fewer breeding ponds, and many of these ponds have gone dry before the tadpoles could hatch into frogs.

Among northern animals, adult wood frogs have developed a unique way to survive our harsh northern winters. They have the remarkable ability to thaw out and resume normal activity after being frozen solid deep under the forest litter all winter. When you hear these small northern creatures calling during the next few weeks, remember you are not alone in celebrating the arrival of spring on the Kenai Peninsula.

Ted Bailey, a supervisory wildlife biologist, has been responsible for the Kenai National Wildlife Refuge's biological programs for over 20 years. He and his staff monitor and conduct studies on a variety of refuge wildlife populations. Previous Refuge Notebook columns can be viewed on the Web at http://www.fws.gov/refuge/kenai/.

From dead spruce to bluejoint—out of the frying pan and into the fire?

by Doug Newbould

Calamagrostis canadensis, also known as bluejoint reedgrass, Canadian reedgrass or just bluejoint, is one of the most common and widespread tall grass species in North America. It can be found from Labrador to Alaska and south to the mountains of North Carolina, New Mexico and California. It grows very well at sea level in the North and Northwest, and it can be found at elevations over 12,000 feet in the mountains of New Mexico. Whatever you might call it and wherever it's found, it can mean big trouble to homeowners and firefighters when wildfires occur.

I don't have a lot of data to support this, but I feel pretty confident in saying that most destructive wildfires on the Kenai Peninsula get started and/or spread in bluejoint. I can say this with some certainty because I know grasses and other "flashy" or light fuels carry the majority of wildfires in North America. In fact, almost all forest or big timber fires start on the ground in light surface fuels, before working their way up into the forest canopy. And one of the well-known, "common denominators of fire behavior on tragedy fires" is a flare-up that occurs in deceptively light fuels.

When it comes to light or flashy fuels, *Calamagrostis* is one of the "big hitters." It's the Mark McGuire of the grass fuel types in North America. It can reach heights of six feet or more. It forms root mats and thickets so dense that trees and other plants cannot get established. It reproduces both vegetatively (through its roots) and through seed production. It can cover large tracts of land for relatively long periods of time—Kodiak Island, for example. It responds rapidly to changes in relative humidity, and it can carry fire almost any time of the year (if it's not covered by snow). It can produce flame lengths of ten to twenty feet, and more if down dead woody fuels are present. Fire can travel through it at over three miles per hour with a little wind, and that is an extremely fast rate of spread among forest fuel types.

Here on the Kenai Peninsula, *Calamagrostis* is often associated with open stands of Lutz or white spruce. It grows equally well in the valley bottoms and on the side slopes of the Kenai Mountains. It really seems to thrive in the lowlands and coastal areas of the western peninsula. And it is spreading! Many of the areas that were, until recently, covered by mature stands of Lutz spruce, are now grasslands with lots of dead wood. Of course these areas are also where many Peninsula residents choose to live.

I know that many of you have been doing your best to reduce or eliminate the dead spruce hazard fuels from around your homes. And I am proud of the effort we fire managers have made to spread the word about defensible space and fire prevention. But I am not very confident that all Peninsula residents understand the dangers of wildfire in tall grass fuels. I am concerned that after all of our efforts to mitigate the impacts of the spruce bark beetle, there will be a letdown of sorts. And some folks might lose their hard-earned caution concerning wildfire ignitions in the wildland-urban interface.

For these past several years, as the beetles spread their influence across the Peninsula, we have been focusing on dead trees—and rightly so. We need to continue the work of tree removal in the interface, where public safety is at highest risk. But I believe now is the time to add another component to that focus—reducing the risk of wildfire in *Calamagrostis* fuel types.

How can we stop the encroaching grasslands? Well, there are ways. One of the best ways is to plant other species before bluejoint invades. Hardwood (deciduous) trees and bushes are a good choice. Other grasses, Forbes and wildflowers can also work well. Talk to your local nursery for planting ideas. Some people choose to burn their dead grasses every year in the spring to remove the threat and encourage new growth. This can be effective, but it can also be the start of a wildfire. I know some folks who have experienced this, and they did not enjoy it. Another way is to mow it or cut it back periodically, to keep it from forming tussocks and building up a fuel bed. I am not sure about the effectiveness of herbicides on bluejoint, and I would not recommend chemical treatments anyway—due to their detrimental effects in the ecosystem.

I don't want you to think I dislike bluejoint or think I believe it's some evil force—marching across the landscape. No, I believe *Calamagrostis canadensis* is one of nature's finest examples of a ubiquitous and efficient species, much like the spruce bark beetle. I think we just have to find a way to coexist with it, without burning down the house!

Doug Newbould is a fire management officer at the Kenai National Wildlife Refuge. For more information about the refuge, stop by headquarters at the top of Ski Hill Road in Soldotna, call (907) 262-7021.

Bark beetles biting dust?

by Ed Berg

I spent a recent weekend on a geology fieldtrip to Seldovia. What a pleasure it was to hike through a live spruce forest! The towering green Sitka spruce along the Otterbahn Trail reminded me of the forests on the Homer side of Kachemak Bay ten years ago, before the spruce bark beetle shifted into high gear. The beetles have generally been moving down Kachemak Bay toward Seldovia. If a conservative observer were to judge the future by the recent past, he would predict that Seldovia too will inevitably fall to the beetles within the next several years. We used to say that "time and tide wait for no man," but some would update that to time and beetles…

I disagree. I think that we have turned the corner and the beetles are in full retreat. Seldovia, and probably Kenai and Soldotna may well escape comparatively unscathed. Don't cut anymore trees until you've pondered the following observations!

First observation: the red-needle (fresh beetle-kill) acreage has dropped about 50% per year for the last three years on the Kenai Peninsula, according to the Forest Service's annual aerial surveys. This is primarily due to the beetles having eaten themselves out of house and home: from Tustumena Lake to Kachemak Bay there is simply not much mature forest left to eat. I admit that this says nothing about what will happen to the remaining survivors. Anchor Point held its own during the mid-1990s when everything to the north, east, and south was being hammered, but Anchor Point finally showed a lot of red trees in 1999. Being a temporary survivor didn't help Anchor Point.

Second observation: we have just had two relatively cool and wet summers. On the southern Peninsula there was a record drought from 1989 through 1997, which greatly turned up the volume of beetle activity. Warm temperatures increase evapotranspiration and drought-stress the trees. Even worse is the "long warm summer" effect (as shown by high degree-days figures) which allow the bark beetles to complete their normal two-year life cycle in one year. A long warm summer effectively doubles the beetle population, because in the following spring both one- and two-year beetles are released simultaneously.

This happened in 1993, 1994, and especially in 1997. In 1998 and 1999, however, in Homer annual precipitation was close to the mean and summer temperatures were down to the mean. These were two very "average" summers for the southern Kenai, and this means poor beetle reproduction and more beetle-resistant trees. These facts could save Seldovia, which still has very mature green trees, as well as help Anchor Point defend its younger trees.

In the central Peninsula it looks even better: annual precipitation was 15% above normal (and summer precipitation was 45% above normal) in 1998 and 1999, and summer temperatures were down to the mean, in sharp contrast to the warm dry summers of 1996 and 1997. These facts spell good news for tree-lovers from Kenai to Sterling and northward to Point Possession.

Third observation: a 20-30 year cycle in North Pacific sea surface temperatures has recently been identified by climatologists Steven Hare and Nathan Mantua at the University of Washington. Kenai and Homer, being coastal communities, track this cycle very closely in their annual temperatures. This cycle warmed up in the 1920s and 1930s, cooled down in the 1940s through the mid-1970s, and began warming up in 1977. In 1998 however the North pacific sea temperatures began falling, and in 1999 they dived to chilly 1960s levels. This suggests that we may already be two years into a new 20-30 year cool phase. If so, we should see the beetles drop to insignificant background levels.

Fourth observation: it's hard to beat youth. Many of the stands in the Kenai-Soldotna-Sterling area are relatively young and beetle-proof. The two 1926 Burns south of Soldotna to Kenai have only moderate beetle-kill. The 1947 Burn in the Sterling area has very little beetle-kill, although much of this 310,000-acre burn is black spruce, which is rarely bothered by the spruce bark beetle. The 1969 Burn north of Kenai is much too young for beetles. Of the mature spruce forest north of the Kenai River (e.g., Swanson River Road north to Point Possession), much of this was severely beetle-thinned in the early 1970's (following the drought of 1968-69), and the surviving (i.e., younger) trees are growing vigorously and are not yet very susceptible to beetles.

Fifth observation: climate-wise, 1997 should have

been the ultimate year for beetle babies, if there were enough beetle parents available. The summer of 1997 was one of the longest and warmest summers on record, as measured by total degree-days above 60° F. Homer recorded 360 degree-days (mean 135), Kenai 477 degree-days (mean 240), and Sterling 1049 degree-days (mean 737) for May through August of 1997. This should have produced a huge crop of one-year beetles in 1998, on top of the normal two-year crop from 1996. It generally takes 2 to 3 years after a beetle "pulse" like this to see the red-needle acreage figures jump up in the annual aerial surveys. This means that in 1999 and 2000 the remaining live mature spruce trees on the Kenai Peninsula should be turning red, if there were in fact available beetle parents in 1997. We didn't see many red-needle trees in 1999, so this year is the critical test. With luck, there weren't enough beetles around in 1997 to take advantage of the good weather and their offspring didn't do much damage.

The next several weeks will provide an excellent window to assess the beetles and the future of the remaining spruce trees. Two field observations are needed, and I am asking for the readers' help. First, the beetle mating flight could occur any day now, as soon as we have several 60° F days in a row. I would like people to report flights where they see dozens (not 4 or 5) of bark beetles flying around. In the past we have had Alfred Hitchcock-style in-your-face beetle flights, and even clouds of beetles visible at a distance. If we see anything like this, we might as well get out the chainsaws.

Second, I need observations of fresh red-needle trees (many trees, not 2 or 3). The needles of recently killed trees turn red in the late winter and early spring, and drop off over the next year. Driving along the Sterling Highway between Anchor Point and Ninilchik, I notice some clumps of red-needle trees, but a lot of the trees are already dead (and gray, with no needles).

To sum up, my predictions for this spring are that we won't see any large beetle flights, or very many fresh red-needle trees. I think we are indeed over the beetle hump, but I may be wrong. I'd greatly appreciate a call with you observations. I can be reached during weekdays at the Kenai Refuge headquarters in Soldotna at 260-2812, and on weekends in Homer at 235-7268.

Ed Berg has been the ecologist at the Kenai National Wildlife Refuge since 1993. Previous Refuge Notebook columns are on the Web at http://www.fws.gov/refuge/kenai/.

What happened to my campground?

by Bill Kent

This is the time of year when the acts of a very few visitors to Kenai Refuge come into sharper focus for me. Perhaps the spring weather makes my aging eyes a little sharper, or maybe its just because I am outside more… who knows? What becomes more evident as the snow berms melt is the destruction of, and total disregard for the facilities and resources (public and private) of the entire Kenai Peninsula practiced by a small but active segment of the population. They seem to think the campgrounds, signs, toilets, trails, sheds, mailboxes, fences, and other structures are erected with the intended purpose of being shot, burned, torn apart, stolen, or generally defaced.

Please understand, I was born and raised in Georgia where, as in most of the South, destructive vandalism is a way of life learned at an early age by many. So, this behavior is not unfamiliar to me. Nor is it limited to the South; I have seen similar situations in every part of the country where I have worked and lived. But, those examples pale in comparison to the magnitude of the havoc wreaked throughout Alaska, not only on the Kenai Peninsula. Do I notice the vandalism more because I live here? Of course I do; my family made a decision to make Alaska our home, and a thoughtless few it seems are trying to tear it apart or burn it down, and I don't like it.

As a test, consider any single mile of the Sterling Highway (outside the limits of Soldotna, Cooper Landing, or Sterling) where signs have been punctured or defaced with various caliber bullets, shotgun pellets, or spray paint; or where trash (sometimes entire bags) is strewn along the roadside.

I would like for you to understand the monetary cost of this destruction. Many of our signs are made of wood, with routed lettering. If you've done any construction work around the house, you know that lumber and paint are expensive. Our carpenter who makes these signs is paid a fair hourly wage for his skills. The total cost of a 3ft by 4ft sign is about $400. Repairing gunshot wooden signs is time consuming and not inexpensive. We also use aluminum signs which, depending on the size and lettering, may cost anywhere from $10 to $500, or more. Replacing these signs after they are shot or otherwise vandalized is a serious drain on our budget each year, and many signs cannot be repaired.

Besides the time and tax dollars spent replacing signs, there is a real image problem portrayed to the visitor. And even more important, sign shooting is done with total disregard for public safety. When you shoot along a road, it is only a matter of time before some motorist, bicyclist or pedestrian gets injured or killed.

Occasionally someone thinks burning wooden outhouses and picnic tables is great fun, or takes a picnic table out to the middle of a lake during ice-fishing season. This is why we have been replacing our wooden outhouses and picnic tables with ones made of concrete. Every once in awhile there may be a little justice: a couple of years ago someone shot up the inside of one of our new concrete outhouses. I can't imagine that this person had too much fun immediately after pulling the trigger from inside four concrete walls.

"Well," you might say, "Why don't you catch them?" That is a desire of everyone on our staff, no doubt. The biggest barrier to catching someone vandalizing a campground or shooting a sign is being in the right place at the right time. Our best help comes from people who witness something happening and provide information about vehicles or descriptions of the vandals. We cannot be everywhere at once, and are grateful when someone concerned about their Refuge provides information which we can use to bring charges against those who destroy facilities that belong to all of us.

If you would like more information about the vandalism problem or would like to provide us with information about vandalism that you have witnessed, give me a call at Refuge Headquarters (262-7021). People can also phone in anonymous tips to Crime Stoppers in Kenai at 283-8477, or to Wildlife Safeguard at 800-478-3347.

Bill Kent has been the Supervisory Park Ranger at Kenai National Wildlife Refuge since 1991. His wife Lisa is a pre-school teacher, and their daughter Riley attends SOHI.

Kenai National Wildlife Refuge summer programs

by Candace Ward

Are you a nature lover interested in Alaskan wildlife and cultural history? Then we invite you and your family to join the Kenai Refuge staff for a variety of summer programs. Popular topics range from moose and bears to birds and Alaska cultural history.

Campfire Programs:

Hidden Lake Campground - Saturdays, May 27 - Sept. 2, 2000, 8:00 p.m. Fridays, June 23 - August 11, 2000, 8:00 p.m.

Upper Skilak Campground - Saturdays, July 1 - July 29, 2000, 8:00 p.m.

Campfire programs last one hour. For Hidden Lake campfire programs, meet at the campfire amphitheater. (If raining at Hidden Lake, meet at the picnic pavilion next to the boat ramp.) For programs at Upper Skilak, meet at the picnic pavilion. Dress for the weather.

Directions: Hidden Lake Campground is located on Skilak Lake Road, 3.6 miles from the east entrance on the Sterling Highway (near Jim's Landing). Upper Skilak Campground is also located on Skilak Lake Road, 8.4 miles from the east entrance.

Discovery Walks:

Burney's Trail, Hidden Lake Campground - Saturdays, June 17 - August 12, 2000 - 1:00 p.m.

Discovery walks last 1 2 - 2 hours. Hikers cover 1.5 miles round trip. Wear comfortable hiking shoes, bring rain gear, and carry water. A spectacular view of Hidden and Skilak Lakes awaits you at the end of the hike.

Directions: The trail head is located in Hidden Lake Campground across from site #7, Skyview Loop. Park in the boat ramp parking lot and walk to the trail head. The campground is located, 3.6 miles from the east entrance on the Sterling Highway (near Jim's Landing).

Nature Walks:

Kenai National Wildlife Refuge Visitor Center - Sat. & Sun., 11:00 a.m. - July 1-Aug. 13, 2000

Nature walks last 30 - 45 minutes. Distance covered is 2 mile. Wear comfortable walking shoes and clothing for the weather. Walk ends at the scenic overlook on Headquarters Lake.

Directions: The visitor center is located on Ski Hill Rd., one mile from Soldotna. Turn south off of Funny River Road onto Ski Hill Road at Spenard Building Supply.

Wildlife Films:

From June 3 - August 20, 2000, films featuring Alaskan wildlife are shown at noon, 1, 2, 3, & 4 p.m. daily at the Kenai Refuge Visitor Center in Soldotna. Visitor Center hours beginning June 3 are Monday - Friday, 8 a.m. - 5 p.m., and Saturday, Sunday & Holidays, 9 a.m .- 6 p.m.

For more information on our summer programs, contact Kenai National Wildlife Refuge at 262-7021. This schedule is posted on our refuge website at http://www.fws.gov/refuge/kenai/.

Candace Ward has worked as park ranger at Kenai National Wildlife Refuge for 15 years specializing in refuge information and education programs.

You saw what?

by Robin West

The phone at the Refuge office rang and the caller asked to speak to a biologist. After getting connected the caller starts, "You're probably not going to believe this, but I saw a..."

This call comes in many times a year. Sometimes the caller saw something that they only believed was rare, but actually is seen regularly by our staff working in the field. Sometimes the reports are of critters that really shouldn't be found anywhere in the area, but strange things happen in nature. And sometimes the reports are pretty far fetched.

Examples of the first category include such things as wolves and wolverines. A sighting of these animals for many is a rare event, yet biologists working in remote areas, or flying aerial surveys, rarely pass a month without observing one or both of these species.

Examples of the second category include animals like mountain lions and deer. We have received several unconfirmed reports of mountain lions (or cougars) on the Kenai Peninsula during the past several years. None of these has been confirmed, but on occasion, mountain lions have ventured into areas of Alaska. They are secretive creatures and are not commonly observed even where they are abundant. It's likely that some of these reports come from people observing something else, yet, some of the observations have come with adamant testimony, and it is quite possible that the observations have been accurate.

A report was received from a caller a couple of winters back who claimed to have seen a Sitka blacktailed deer in the Skilak Loop area. Biologists were not convinced; however, the following spring a winterkilled doe was found in the general area where it had been initially reported. Of course deer are scattered on some of the islands and coastal areas of Prince William Sound, but what got into this individual to make the trek across the Kenai Mountains, no one will ever know.

And we are still looking for a flying squirrel. We have observed a strange girdling of birch stems (usually 1 to 2 inches in diameter) which possibly was done by flying squirrels. Occurrences of this girdling are extremely sporadic, e.g., near the gate on Swan Lake Road and along Finger Lakes Road, but we have seen no fresh sign for several years. No birds, other mammals or insects are known feed on birch in this manner; flying squirrels are our best hypothesis, but we have never seen a flying squirrel on the Refuge, let alone seeing one actually peeling birch bark around a stem and eating the inner bark.

Here are some examples of the far-fetched category. These are kind of like seeing Elvis arrive at your neighbor's house (in a flying saucer). I had only been here a few months when I got my first such call: Bigfoot was seen on the Funny River Horse Trail. Now I'm not saying the caller didn't see Bigfoot, but I sure would like to see Bigfoot with my own eyes before I add it to the resident Refuge species list.

All in all there are approximately 41 species of mammals and 177 species of birds that have been verified to occur on Kenai National Wildlife Refuge. Clearly some of these are quite common, such as moose and bald eagles, while others such as red fox, snowy owls, and great blue herons are rarely seen. As climates and habitats change, wildlife populations expand, or flukes of nature occur, new species will undoubtedly populate the area.

We are very interested in getting reports of unusual wildlife sightings. And yes, sometimes you may get a raised eyebrow when you tell the biologist what you saw, but don't let that dissuade you. If you do observe something you believe to be really rare, a little detective work on your part can add greatly to your case. Obviously a good photograph or video footage would be great, but a plaster cast of a track, or if the opportunity arises, the collection of a feather or some hair, can be used to conclusively identify the animal. Please don't shoot it and bring it in. I say that because if you do see Bigfoot, I don't want it said that I am to blame for its demise.

Have fun watching wildlife, and keep those calls coming in!

Robin West is the manager of the Kenai National Wildlife Refuge. Previous Refuge Notebook columns can be viewed on the Web at http://www.fws.gov/refuge/kenai/.

Salmon season on the Kenai

by Greg George

'Tis the season once again. People everywhere are feeling the spirit. The stores are having sales and the radio, TV and newspapers are constantly reporting about it. To cement the fact that the season is upon us, we are now regularly hearing from family and relatives. Now that summer is really here, it can only mean one thing: It's Salmon Season On The Kenai!

Our day-to-day summer activities can feel stressful compared to the calm of winter. Visitors, family and friends fill our homes, B&B's, stores and streets. The boat shops are hurrying to get boats ready, the tackle shops have the shelves stocked, and we are getting excited. This is the time to put salmon in the freezer and fire up the smoker for those mouth-watering delights.

Where salmon are concerned, there is something for everyone on the Kenai. You can troll in saltwater, drift or motor a river, or simply stand at the water's edge. Some popular salmon fishing spots are the Homer Spit, Halibut Cove, Anchor Point, Ninilchik, Kasilof, Seward, Hope, and of course, the Kenai and Russian Rivers. There are many places to fish, and different regulations for each place.

Before you head out for a day of fishing, be sure you have your year 2000 fishing license and a copy of the year 2000 fishing regulations. You should be able to pick up both at the same place. The regulation booklet is an essential item to take with you. It tells you what tackle is allowed, what stream banks are being protected to prevent erosion and what is open for fishing. Don't be overwhelmed by the booklet. Thoroughly read about the water in which you plan to fish and don't be afraid to ask questions of a wildlife officer or at your favorite tackle store. Most parking areas and boat ramps have the regulations for that area posted.

If you decide to fish for a king salmon on the Kenai River, be prepared for a lot of work. Kings can be huge, like the world record fish that was more than 97 pounds! Fishing from a boat will give you the best opportunity. A boat can follow a king up and down the river, preventing you from losing an entire spool of line. Whether you go in your boat, a neighbor's boat or with a guide, wear a life jacket and bring layers of clothing, rain gear, sunglasses and snacks. The weather can change quickly and you'll need to keep your energy up when fishing that king. A good bank fishing opportunity for a king is on the Kasilof River at Crooked Creek State Park, where fish exceeding 30 pounds have been caught.

If red salmon are more to your taste, the Kenai, Kasilof and Russian Rivers have what you are looking for. Bank fishing opportunities are more abundant for red salmon than kings. Again, read the regulation booklet because different sections of the same river can have different tackle restrictions. "Combat fishing" is most commonly associated with the Russian River area. Many places along the Kenai and Kasilof Rivers are known as "combat zones" and should be fished with caution. Eye protection is a foremost consideration as hooks and lead weights are in constant motion in these areas.

The Central Peninsula General Hospital Emergency Room removes more than 100 impaled fishhooks from unlucky anglers each year. Pliers are a handy tool to take when fishing for reds. It is easy to unhook a salmon, especially ones that are hooked anywhere other than the mouth that has to be returned to the water. (And please handle "snagged" fish carefully—future runs of salmon depend on the successful return of some fish to spawning grounds. If you snag a fish, remember to handle it as little as possible as you release it, and be gentle! Don't drop kick the fish back into the water.) Lastly, don't forget an extra dose of patience for your shoulder-to-shoulder "combat" experience. Go to a "combat zone" expecting a busy social gathering of people having fun, not solitude.

A fun, family salmon is the pink, or "humpy." The Kenai River has a run of pinks on even-numbered years. The past few runs have been very productive. When pinks are in the river, they are hard to keep off of your hook. Bank fishing is often successful to anglers of all ages in the Kenai River and in Hope.

Silver salmon are very aggressive and exciting to catch. Both salt water trolling from Seward and river fishing can be rewarding for this late summer salmon.

When salmon fishing is good, it can be tempting to catch a whole summer's worth in a day. It is important to know the daily limit and possession limits.

A fish being stored on ice in a cooler is considered to be in possession, not preserved. Salmon fishing can be very expensive. Don't add to the cost by being cited with an over limit of fish.

You might have a favorite recipe for cooking, or a favorite brine for smoking your salmon. Do others the favor of sharing some of your recipes, and you may find new ones you like too. If you are going to store salmon for any length of time, try vacuum sealing or canning it. Vacuum bags don't break like glass jars do, but they need to be kept frozen. The Alaska Cooperative Extension will test your canning gauges for free. If you are going to send frozen salmon to someone, use a next day or 2nd day shipping service and an insulated box. Temperatures in other parts of the country can be very hot right now, especially in a delivery truck and on airport loading ramps. These ideas can help keep that precious cargo from going bad.

If you are floating the upper Kenai, look for Dall sheep on the mountainsides. When you are fishing the lower Kenai, keep your eyes open for an osprey. If you are trolling the salt water, keep alert for porpoise off the bow. While you are standing on the water's edge, remember that you are out of the office. Keep your hook sharp, your eyes protected, your camera handy, and most of all, enjoy your wonderful wild salmon season!

Greg George is a law enforcement officer on the Kenai National Wildlife Refuge. Previous Refuge Notebook columns and general information about the Refuge are on the web at http://www.fws.gov/refuge/kenai/.

Up close and personal with moose and caribou

by Stephanie Rickabaugh

When the subject of moose or caribou comes up in a conversation, it usually revolves around the bulls. But have you ever considered the energy requirements of the cows? Their nutritional requirements and the additional needs for calving and raising calves is one of the projects that I spent the last four winters researching at the Moose Research Center (MRC). Working with 25 moose and 17 caribou at the MRC certainly had its moments—both scary and hilarious.

The MRC is run by the Alaska Department of Fish and Game (ADF&G) but it is located within the Kenai National Wildlife Refuge. It consists of four fenced pens, each one square-mile in area, research buildings and living quarters, and is located at the end of Swan Lake Road south of Coyote Lake.

The MRC was constructed in the mid-1960's to study the relationship between moose and vegetation. Research has focused on moose browse, and more recently on nutritional effects and carrying capacity. Under the sometimes distant (30+air miles from Soldotna) supervision of ADF&G's Tom Stephenson and Kris Hundertmark we repaired miles and miles of fencing, built pens, repaired roofs and trucks, and converted to solar- and wind-generated electricity.

One of our projects monitored body parameters and feed intake of cow moose. Before feeding trials began, I observed the cows throughout the rutting season. Moving animals around and setting up a breeding plan for each cow, in addition to confirming when they became pregnant proved to be a tricky and often scary task. When a bull moose in rut sees you as a threat to his status, you know you have a problem!

Most cows will breed during the first or second estrus (heat) cycle, which usually begins near the end of September. I would go into the pens to locate the cows and observe their behavior. From such behavior as body posturing, vocalizations, rubbing, and proximity to one another, I could tell when cows were coming into heat and could estimate their best breeding times.

As soon as the rutting season was finished, we started preparing for feeding trials. Using two different pelleted feed rations, we simulated high and moderate quality winter diets. There were many aspects to these trials but one I will always cherish was getting ten moose and six caribou trained to use an individual-specific feeding-gate system. I had to train the animals to recognize which gate was theirs and how to open their private gate using a censored magnetic "key" on a collar around their necks. Since these research animals are still instinctively wild animals, even just getting the cows habituated to my presence was a very challenging task, let alone teaching them to use magnetic keys to open individualized feeding-gates.

Once the animals were trained to the gate system, we began weighing the amount of feed offered and refused for each animal in the feeding trial. This enabled us to determine the consumption levels for each individual. We also collected bi-weekly body weights on the animals… another daunting task that required maneuvering these animals onto a stock scale! Consider, if you will, getting a moose into a horse trailer—now you're getting the picture! Nonetheless, by the end of my third winter, with many tricks behind me, I think that I had educated these cows to their "assignments."

During the trials we also collected blood samples and used an ultrasound to measure body fat and determine pregnancy and twinning. Measurements of body fat provide an index of the animal's body condition. The thicker the body fat, the more overall stored energy the cow has for calf development and survival through harsh winter conditions. This provides important information in assessing habitat quality and thus overall productivity and survivability of a given population of moose. Over the last several years, Fish and Game biologists, in conjunction with federal and other state agencies, have been collecting similar data from moose populations around Alaska for comparison.

Since pregnant cows were used in these trials, it was important to continue monitoring them throughout the spring and summer. The number of calves born and their birth weights are key indications of the condition of the cow. Thus, a cow living in poorer habitat (or given a poorer pellet ration) may have less body fat, more difficulty in winter, and produce a weaker calf or calves.

Here on the Kenai Peninsula, we have seen outstanding moose habitat as a direct result of the 1947

and 1969 wildfires. But as the forests in these massive areas mature, the quality of the habitat for moose populations decreases, leaving few areas with good quality moose browse (i.e., willow, birch and aspen). The research being done at the Moose Research Center is directly applicable to "real life" moose populations and continues to help biologists assess the moose/habitat relationship on the Peninsula and around the state.

I'd like to thank the folks connected to the MRC for giving me the chance to work with and learn from them. I am definitely worn, but wiser for having spent four challenging and COLD winters at MRC.

Stephanie Rickabaugh works as a wildlife technician at the Kenai National Wildlife Refuge. For the past four winters she has worked for the Alaska Department of Fish and Game at the Moose Research Center.

Most wildfires on the Refuge caused by campfires

by Doug Newbould

Americans love to camp out. It's one of our all-time favorite summer activities. Camping is as American as the Beach Boys, baseball, and Mom's apple pie. And what camping experience is complete without a crackling campfire and a marshmallow on a stick, or a steaming pot of camp coffee? Campfires can even mean the difference between life and death in the Alaskan wilderness.

But there is an unfortunate downside to campfires, especially here in south-central Alaska—they cause a lot of wildfires. In fact, over the past 60 years (about as long as we have kept fire records), escaped or abandoned campfires are by far the number one cause of wildfire on the Kenai National Wildlife Refuge and other public lands on the Peninsula.

Some of the more notable Refuge fires in the past 60 years that are known or suspected to be caused by campfires include the 1947 fire (burned over 310,000 acres), the 1969 Swanson River fire (over 90,000 acres), the 1974 Chickaloon fire (17,000+ acres), the 1991 Pothole Lake fire (7,000+ acres), and the 1994 Windy Point fire (1,000+ acres).

Since I came to the Refuge fire management program in December 1997, every reported wildfire has been the result of an abandoned campfire. Every one of those campfires was in a remote, undeveloped campsite. Fortunately, we were able to locate and put out those fires before they became large, destructive wildfires. At least two fires had the potential to get big: a fire on the south shore of Hidden Lake in 1998, which burned about a half acre; and last summer, there was an abandoned campfire at the outlet of Skilak Lake that burned about 200 square feet of the forest floor.

Looking at these fires collectively, we see some common characteristics: the fires were built in primitive campsites without established fire rings or pits; the campfires were abandoned by the people who lit them (we were unable to locate the responsible parties, which means the taxpayer picks up the tab for suppression costs); the fires escaped by burning roots or organic material (duff) below the surface; and the fires were discovered/reported by other campers or recreationists many hours or days after the fires were abandoned.

Having personally inspected many of these sites, it was obvious to me that in most cases the campers made some attempt to extinguish their fires before leaving. My guess is that either the campers were unaware that fire was burning (creeping) in the duff or they did not have the tools necessary to put the fires out. This assumption leaves out those who are just lazy, no-good bums who don't care about the environment, people, or their natural heritage. The other, and perhaps most important characteristic of these fires is that they were ALL PREVENTABLE!

To ensure that you do not become one of these unfortunate statistics—or even worse, have to pay for the cost of your escaped campfire, here are some simple "CAMPFIRE" safety rules to follow when you build the next campfire: Choose a safe location for your campfire—away from overhanging branches, steep slopes, rotten stumps or logs, dry grass, leaves or brush. Always keep a shovel and water nearby—in case the fire escapes, or to help put the fire out cold when you are done with it. Make sure you know the rules of the land you are using—open campfires are illegal in some areas and at certain times of the year. Prepare the area around your fire before you light it - remove flammable materials within five feet of your fire ring or pit. Fires should never be started with flashy flammable liquids like gasoline or white gas—carry safe firestarters with you or use dry leaves, grass, feathermoss, lichen, or bark. Impact the surrounding environment as little as possible—don't butcher live trees by breaking branches; collect deadwood from the ground or dead-standing trees. If it is not an "established" primitive campsite, obliterate your firepit after the fire is out cold. Make sure your fire is dead out before you leave (drown it with water, stir and mix with dirt, carefully feel all materials with bare hand to make sure they're cool, and make sure no roots or duff are burning at the edges of your fire). Economize—keep your fire small; a good bed of coals or a small fire surrounded by rocks gives plenty of heat, and small fires are easier to put out.

Above all, remember not to light a fire when drought or extremely dry conditions persist, especially if the wind is blowing. The warmth and satisfaction of

a little campfire is not worth the suffering you would endure if it got away from you and burned up thousands of acres of forest, wildlife, someone's home, or worse.

Be a happy camper—be smart with campfires. You owe it to the rest of us!

Doug Newbould is the fire management officer at the Kenai National Wildlife Refuge. For more information about the Refuge, stop by Headquarters at the top of Ski Hill Road on Soldotna, call (907)262-7021 or visit our web site at http://www.fws.gov/refuge/kenai/.

A view from the high country

by Ed Berg

A trip to the high country is always close to the heart of the biologist. In the high alpine meadows and rocky slopes we see a great diversity of the little plants and lichens, often in great profusion, which we don't see in the muskegs and black spruce forests of the lowlands. In the high country the concept of "biodiversity" comes alive, with 20-30 species of mosses, lichens and liverworts on a single boulder, and dozens of species of flowers, and grasses and sedges, all blooming within a few weeks of the highly compressed growing season.

Sexual energy is intense among the small denizens above tree line; you can hear it in the hum of the bees as they busily carry pollen from one blossom to the next. Moss capsules and lichen sporangia are bursting with spores, and willow catkins are beginning to ripen so the wind can take their cotton-plumed seeds to new germination sites.

Asexual reproduction, too, is going full blast in the high country, although in less showy ways. Sedges are "tillering" (producing new shoots from underground runners); lichens are dispersing fine powdery fragments of themselves, each of which can regenerate a new lichen; and wingless aphid females are cloning babies without any male help at all. The dandelion, too, has given up sex: all those seeds are clones.

I make several trips a year to the high country, ostensibly for scientific purposes, but more for matters of the heart. God seems closer among the flowers in the high meadows and I am reminded that I am simply one creature among many, each of us taking our turn on the Great Cosmic Wheel. The hunter seeks his quarry, the miner seeks his mother lode, and the biologist seeks his specimens and numbers, but we're all drawn to the high country as pilgrims are drawn to Mecca.

With these thoughts in mind, I tighten my seat belt in the Refuge's Cessna 185 as Pilot/Biologist Rick Ernst lifts off Headquarters Lake and heads east to Twin Lakes at the top of Benjamin Creek, beyond the Killey River Canyon. As we descend into the rocky Twin Lakes basin, Rick points out a very blond sow with three nearly full-grown cubs on a nearby ridge. We land and unload our gear, adjust our packs, and set off cross-country through the willow thickets.

This country is not easy walking for the overloaded backpacker. Our leader Ranger Gary Titus has long legs like a moose and seems to stride effortlessly over the tussocks and through the willows, but Ranger Dave Kenagy and I are shorter (and older), and have to pick our way at a slower rate. There are no trails here, so we study our route carefully to minimize the willow and alder thickets. We make one knee-deep stream crossing, where my lightweight sandals and stout walking stick prove their worth. We set up our first night's camp on a high meadow bench with enough breeze to keep down the bugs.

After dinner, Gary and Dave hike north in search of critters, and find a very large boar, and a black bear, which they graciously shoo off in my direction. I spend a delicious couple of hours exploring the meadow with collecting bags in hand getting reacquainted with old flowering friends like valerian, arnica, narcissus anemone, lousewort, cassiope, and forget-me-nots. Several wet seeps are "hot spots" of biodiversity with concentrations of moisture-loving mosses and liverworts like *Sphagnum*, *Plagiomnium*, *Ptilidium*, and *Marchantia*.

The drier, more open ground is often covered with miniature gardens of lichen. I am pleased to see the shrubby lichens in good abundance because they can carry the caribou through the winters. One of my scientific purposes of this trip is to evaluate the Twin Lakes-Benjamin Creek drainage for lichen forage for the caribou. In 1987-88 a herd of about 50 caribou were introduced by helicopter into the headwaters of the Killey River above Tustumena Lake. These caribou have reproduced very successfully and now number about 450. In the winter they forage for lichens on the high wind-swept slopes and ridges, where they can "crater" with their hooves to get at the lichen beneath the snow.

In 1998 Carlos Paez and I surveyed the Killey River headwaters for lichens, and found that the caribou were eating themselves out of house and home. The lichens were really hammered, and we have become concerned about a possible die-off of this herd in a hard winter. Fortunately, some of the more assertive

(i.e., more hungry) individuals have crossed the Killey canyon, perhaps near the glacier, and have moved into the Benjamin Creek drainage, where I am seeing much better lichen availability. Hopefully more of the herd will follow suit. Even so, on this trip we saw only four caribou, whereas in the western headwaters of the Killey we would have seen hundreds.

On day two we climb a high pass and drop down into the headwaters of King County Creek. We camp on a small beaver lake east of Marmot Lakes, and bemoan the lack of a fishing pole because the water ripples are practically piling up on top of each other. How could we have forgotten such an essential item!?

On our final day we hike down the beautiful Cottonwood Creek trail to the south shore of Skilak Lake. Dave's backcountry crew has cleared out most of the beetle-kill blow downs and the trail is in great shape. It descends through a hemlock zone, then through a mixed hemlock-spruce forest (which Dave says is inhabited by hobbits), and then through a lush spruce forest with lots of alder, devil's club, and pushki (cow parsnip), which looks very much like the forests of Kachemak Bay.

Refuge mechanic Mark Wegner picks us up in the Boston Whaler, and our arrival at noisy Upper Skilak boat landing with kids and scooters reminds us that life has not missed a beat in the lowlands while we were in retreat up in the high country. I'll spend the next weekend identifying and mounting my three Ziploc bags of plants and lichens, recalling each one's special spot on those untrammeled high meadows and slopes.

Ed Berg has been the ecologist at the Kenai National Wildlife Refuge since 1993. Previous Refuge Notebook columns and information about the Refuge can be found on the Web at http://www.fws.gov/refuge/kenai/.

The Hideout Trail

by Richard Johnston

If you're looking for something to do this week, my top recommendation is to hike the Kenai National Wildlife Refuge's newest trail. It is called the Hideout trail and has recently been formally opened to the public, although several hikers and Refuge staff have already sampled this short, but very nice trail. Last fall after construction was completed and again this spring, hikers have reported that the Hideout Trail is a great way see and experience Kenai National Wildlife Refuge.

Student Conservation Association volunteers, participating in the highly regarded high school work program, constructed the trail during 1998 and 1999. The 1.5-mile trail is now ready for general hiker use and new signs should make it easy to find. In recent years challenging day trails have become one of the most popular outdoor recreational activities on the Refuge. If you like Bear Mountain, Skyline, Fuller Lake, or Bernie's Trail, Hideout is sure to become a family tradition. It is short, yet challenging, with plenty of time left over to squeeze in dinner at your favorite restaurant or select another Refuge activity on the same afternoon.

The Hideout trail is located at approximately 1.5 miles from the east entrance of the Skilak Lake Road and has parking for 6-7 vehicles. The trail begins on the north (up-slope) side of the road. It starts at elevation 550 feet and climbs to 1500 feet at the top of a small unnamed mountain overlooking the Kenai River canyon and Skilak Lake. It's a great day trail for 40-something former serious hikers, families, and visitors who want a two-three hour round trip hike with great views. The trail is sunny and south facing, switch backing to the top through mostly open areas and meadows. Except during spring runoff, be sure to pack your own water. The area seems to be located in a rain shadow of the Kenai Mountains. Despite a relatively wet season on the Kenai during 1998, the trail builders were not rained on a single day during construction.

The first portion of the trail goes through an area burned by the 1991 Pothole Lake Fire where the natural meadows and vegetation breaks aided fire fighters and slowed the rapidly moving Memorial Day weekend fire. Large standing dead cottonwoods that where killed by the wildfire provide a unique and almost surreal presence as one climbs to higher elevations. The lush regrowth of blue-joint reedgrass, fireweed, lupine, and elderberry following the burn make an excellent example of post-fire succession. Raspberries are abundant on the lower meadows and are quite popular with the youngsters.

Near the top, wild flowers are even more abundant and sprinkled among the crowberry carpet in sub-alpine meadows.

Whether observing a distant eagle floating on the wind or a woodpecker pounding on one of the numerous dead cottonwoods, the Hideout Trail is a good place to work on your list of bird sightings. On a recent outing, a Refuge biologist spotted juncos, several white-crowned sparrows and a tree swallow. Don't be surprised to see moose, small mammals, a lynx, or even a black bear.

Sweeping views of Skilak Lake begin almost as soon you leave the trailhead and are one of the main attractions of the trail, both hiking to the top and descending. After leaving the burn area, the trail meanders through open meadows and cottonwoods, then climbs moderately to the top. The high point is an outcrop with particularly good views of the Andrew Simons area of the Kenai Wilderness on the south side of the Kenai River and Skilak Lake. Bear and Russian Mountains and the Surprise Creek Valley are prominent, as is the 8,000-acre footprint of the Pothole fire.

The top point of the trail is a good place for lunch. The relatively open meadows of the south-facing approach give way to thick alders on top. If you like to struggle through dense alders, you could continue along the bench and snag a glimpse of Hidden Lake to the north, but my recommendation is to have lunch on top of the trail and then enjoy the downhill. The trail ends at an area above a steep rock outcrop, not quite a cliff, so watch your youngsters closely near the top and while resting for the return trip.

You probably won't need a compass or fully stocked knapsack for this trail, but be sure to bring your binoculars, water, wildlife and plant books, a jacket for the top and a sense of adventure. And don't

forget to bring the kids...these short trails are good way to kindle a sense of adventure and develop future Harding Ice Field explorers.

Rick Johnston is a Ranger/Pilot for the Kenai National Wildlife Refuge. For more information on the Hideout Trail or other outdoor recreation opportunities on Kenai National Wildlife Refuge, contact Rick or other staff members at Refuge Headquarters. Previous Refuge Notebook columns can be viewed on the Web at http://www.fws.gov/refuge/kenai/.

Moose habitat experiments evaluated

by Brandon Miner

Moose management is one of the most important resource issues on the Kenai National Wildlife Refuge. Opportunities for consumptive (hunting) and nonconsumptive (viewing, photography) uses of moose attract a large number of visitors annually. Moose provide a food base for several predator and scavenger species. Moose are the primary prey for wolves, and moose calves are an important prey time for black bears and brown bears. Many smaller mammalian and avian predators and scavengers such as wolverine, coyotes, lynx, balk eagles, ravens, and magpies scavenge winter-killed and predator-killed moose.

During winter, moose on the Kenai Peninsula feed predominately on shoots and branches of birch, aspen, and willow. These hardwoods grow quickly after a forest fire, but after several decades they are usually overtopped and shaded out by spruce, which grows more slowly and is shade-tolerant.

In the 20th century, two major fires on the Kenai Peninsula in 1947 and 1969 created excellent winter moose habitat. The 300,000 acre 1947 burn in the central Peninsula created record high moose numbers in the late 60s. The 80,000 acre 1969 burn north of Kenai and Soldotna is still a prime moose hunting area, but population estimates from aerial surveys conduced during the 90s indicated that moose numbers declined in this area (from 6.2 moose/square mile in 1990 to 2.4 in 1995).

Many long-time residents of the Peninsula are familiar with past habitat management activities conducted on the Refuge in order to produce better winter range conditions for moose. The Refuge began habitat management in 1954, and through the 1980s thousands of acres of forest were mechanically manipulated by a variety of methods, ranging from handpulling of black spruce to the use of large 40-ton tree crushers. The tree crushers were impressive machines with 3 large steel wheels that knocked down trees and broke them into roughly 3-foot lengths. The tree crushers were used in the 1970s on over 9,000 acres of land in both the 1947 and 1969 burn areas to stimulate sprouting of hardwoods and reduce competing spruce trees, and to scarify the ground for browse species seedling establishment. From 1983 to 1987, approximately 3,500 acres of 1947 burn regrowth were crushed in three parcels in the Skilak Loop and Lily Lake areas; all but 600 acres were subsequently burned using prescribed fire.

I recently conducted a forest regeneration and moose browse study on 10 different sites that had been burned, crushed, or burned after crushing, from 11 to 52 years in the past. We found that browse (aspen, birch, and willow) regeneration was excellent at the sites that were both crushed and burned with prescribed fire, and these areas contained an average of 19,000 stems/acre of browse species. This regeneration was even better than the 1969 burn, which averaged 14,000 stems/acre. Browse densities at the sites that were only crushed contained an average of only 6,000 stems/acre. Clearly, fire is the key "added ingredient" for good browse production.

Different kinds of fire produce different results. We found that the teo most severely burned sites (the 1969 burn and a crush-and-burn site in the Skilak Loop area) contained the highest birch densities. Birch is a prolific producer of winged seeds that can be carried great distances by the wind. The severe fires burned away the duff layer and exposed mineral soil, which is ideal for germination of birch seed.

Aspen on the other hand like a more gentle fire. We found aspen densities were greatest at moderately burned sites (the Lily Lake crush-and-burn site and a second crush-and-burn site in the Skilak Loop area). Aspen thrives after fire because of its great capacity for reproduction by root suckering and most aspen stands are clones of one or several sexually produced individuals. Tens of thousands of suckers per acre are commonly produced when aspen stands are killed by fire. In my research I did not attempt to estimate clone size, but in general clone sizes are small, ranging from a few trees covering less than 0.02 acre up to about 4 acres (although clones occupying up to 200 acres have been found in Utah). A light to moderately severe fire promotes suckering, but a severe burn can eliminate aspen because the roots are "cooked" and killed.

We found that willow was relatively rare at the survey sites, but willow resprouts vigorously from the root crown and is rarely killed even by severe burns,

so the number of resprouting willows will be approximately equal to the number present before fire.

The key advantage to crushing a forest before burning is to get the fuels on the ground so that they can dry out before burning. Pre-drying the fuels created a hotter fire that exposes more mineral soil and provides birch seeds a place to germinate.

To examine how moose utilize browse vegetation I conducted moose browse surveys at several of the study sites, and summarized 15 years of previous browse data from the 1969 burn and the crush-and-burn sites. As expected, we found that percentage of aspen, birch, and willow browsed was lowest in the sites that were 30 years post-burn or older. The percentage of plants browsed was lowest at the 1947 burn sites and the percentage of plants browsed at the 1969 burn sites is declining. The percentage of plants browsed in the early-successional crush-and-burn sites in Skilak Loop was still relatively high in 1999.

Although willow is considered the preferred moose food, willow is relatively scarce, and birch is the principal winter moose food on the Kenai Peninsula because it is most available and palatable. Where present, aspen is also an important winter food. As expected, we found that moose preferred willow above birch and aspen. Between birch and aspen, we found that moose preferentially browsed the less abundant of the two species. Evidently, just like humans, moose prefer a little variety in their diets.

So, what can we expect moose populations to do in the future on the Refuge? With the continued absence of a large-scale forest fire, we can expect moose populations to decline in the central Peninsula as the 1969 burn habitat matures. Compared to the 1947 and 1969 burn areas, the crush-and-burn sites are very small and will not affect moose populations on a landscape scale. The Refuge has a prescribed burning program in the Mystery Creek area, and weather cooperating; perhaps a good burn in this area will generate some hardwood browse and improved moose hunting. Even so, a much larger burn of many tens to hundreds of thousands of acres would be needed to return moose population sizes to the "golden era" of the 1960's.

Brandon Miner recently completed his Master's thesis evaluating the Refuge's crushing and burning programs for moose habitat over the last 45 years. Previous Refuge Notebook columns are on the Web at http://www.fws.gov/refuge/kenai/.

Outside the box

by Natalie Dawson

As a child in overalls with a layer of mud, I never thought much about future experiences in Alaska. I loved nature because I hunted, fished, caught insects and trapped rabbits with buckets and string. Years of experience brought more questions than answers about the natural world, so I began to pursue a career in biology. Growing up in the Midwest, I longed for mountains, large animals and more snow than Michigan could provide. After my first trip out West I knew that the place I would call home would change dramatically as I grew up.

In college I soon learned that it is important to think "outside of the box," i.e., to look beyond conventional wisdom and try to see the big picture. Alaska is definitely outside of the box! After years of dreaming, applying, reading and more applying, I found my way to the Kenai National Wildlife Refuge, where I am working for the summer in a U.S. Fish and Wildlife Service program called the Career Awareness Institute. This program started with two weeks at the National Conservation Training Center in West Virginia, where I learned about different programs in the U.S. Fish and Wildlife Service as well as the Department of the Interior as a whole. I honed some of my field skills and then set out for Alaska for the summer.

Working with the Kenai Refuge biologists, I have learned how to capture wolves and lynx to monitor them with radio collars. I have seen both brown bear and black bears, and have learned how to distinguish moose browsed twigs from twigs browsed by snowshoe hares. I accompanied the Ecology team to an archeological site to take core samples from trees for aging, and I have learned how to operate a grid of snowshoe hare live traps. Working with lynx and snowshoe hares has been especially interesting; smells of cat scent and alfalfa cubes were at one time foreign to me, and I now miss them when they are absent from my daily routine.

Seven weeks of field experience is not nearly enough time to come to conclusions about a future with the U.S. Fish and Wildlife Service, so I hope to work with them again. Nor is seven weeks in Alaska time enough to catch more than a fleeting glimpse of what the forty-ninth state has to offer. After my term at the Kenai Refuge I will work in Denali National Park for a week on a backcountry patrol, hopefully with the biology crew.

My time in Alaska has definitely reinforced my dream of becoming an ecologist. I have learned about the ecology of the northern latitudes, experiencing it first hand on backpacking trips above tree line. Even the tundra, snowfree for such a short amount of time, presents a delicate yet thriving ecosystem.

As my next adventure I would like to try a different approach alltogether, possibly taking an international assignment so that I can not only work in new ecological territory, but also in new cultural territory. I am interested in European conservation methods because Europe has had to confront conservation issues much longer than has the United States. I don't know if the Europeans have been able to think "outside the box" about their environmental problems, but I am eager to learn more about their approach.

I would strongly encourage other students, whether in high school or college to take the opportunity to work outside their familiar environment. Being away from friends and family is the slight price to pay for an unforgettable experience. I have not only seen amazing sunsets on the continental divide and swam in lakes with icebergs floating nearby, I have also met enthusiastic colleagues from all over the world that have taught me about different cultures and shared their viewpoints with me. A person can never know too much, and as an idealistic college student in search of the perfect future, I feel like I can never know enough about that big world outside my own box.

Natalie Dawson is a junior majoring in ecology at Central Michigan University, who is working this summer at the Kenai National Wildlife Refuge. Information on the USFWS Career Awareness Institute can be found by calling 907-786-3510. Previous Refuge Notebook columns are on the Web at http://www.fws.gov/refuge/kenai/.

Refuge environmental education field trip

by Candace Ward and Stephanie Smith

"Wow! I didn't know anything lived under the water!" "This is really cool, I've never hiked on snowshoes before…" "So, bears aren't really bad; they just get into trouble if we're careless and leave food out." If you were a red squirrel in a spruce tree, these are just a few of the comments you'd hear from kids on our Refuge Environmental Education adventures.

Let's take a walk through one of the Refuge field trips first hand. You might be, for example, a 6th grader at K-Beach Elementary School learning "Wetlands & Wildlife."

The program starts when Refuge Environmental Ed staffers Stephanie Smith and Carlie Henneman visit your classroom. Carlie begins with a slide show on the different types of wetlands in Alaska. Then Stephanie leads the whole class in an activity called "Wetland Metaphors," where you have to compare everyday objects with wetland functions.

"How is a sponge like a wetland?" That's an easy one, you think. You remember in the slide show that a bog acted like a sponge when a river overflowed its banks, protecting people's houses from dangerous flooding. Stephanie calls on you and your answer is right! You are "psyched!"

After a few more activities, Carlie and Stephanie explain how to prepare for the upcoming field trip at Headquarters Lake. You learn what you need to wear and what you should expect. You'll be outside rain or shine, so you'd better ask Dad if you can borrow his rain gear since yours has some big holes in it.

The next day you arrive at the Refuge Visitor Center; Carlie and Stephanie welcome your class and go over Wetlands Etiquette. You learn that you're supposed to stay on the trail and boardwalk, and that you need to respect all plants, insects, and animals that you encounter and leave them unharmed. You know this etiquette stuff is important, but you can't wait to get outside and begin the "real" field trip.

Once outside your first stop is on the grassy lawn next to the Visitor Center for a game of "Migration Madness." You pretend you are an arctic tern; you experience lots of hazards on your migration from Antarctica to Alaska. You are one of the lucky terns in your group because you manage to survive the game. You are able to find critical wetlands on your long flight to rest and refuel, so you have enough energy to make it to Alaska for breeding and nesting.

For your second stop Stephanie and Carlie take you to Headquarters Lake. Here you learn how the lake was formed, how pH and temperature affect what lives in the lake, and how specially adapted plants in wetlands help prevent soil erosion. You especially like the pH test, because as you add drops of pH solution, the water color changes like magic from clear to green to purple to give the pH reading.

Your third stop is a boardwalk by the lake where you carefully dip aquatic insects from the lake into a small observation tray filled with lake water. Here you watch how the insects move, learn to identify them, find out if they are in their larval or adult stage, and learn how certain insects indicate that water is clean and healthy for wildlife. You especially like the dragonfly larva with its wicked-looking jaws.

On your fourth and final stop, you work with other kids as a team. You do an activity called "Decision Dilemmas." You are given real life problems involving human activities that affect wildlife and come up with solutions to solve them. For example, you are out on a walk to a local lake with your dog. Your dog is running free. Far ahead down the trail next to the lake, you see a mother moose and her calf. Your dog has not spotted or smelled the moose yet. What do you do?

Summing up, what did you learn on this field trip?

You experienced a variety of fun and educational activities that opened up the world of wetlands. Suddenly you see the world in a different way. Before the field trip you didn't even realize what a wetland was. Now you know why wetlands are important, how wildlife and people benefit from them, and that you have a part in protecting them.

These are the goals of environmental education - to help people understand how the natural world works, how we affect it, and the positive things we can do to protect it. Begun in 1983, the Kenai National Wildlife Refuge Environmental Education Programs have enjoyed the participation of 43,000 students, 1,400 teachers, and countless dedicated parents.

Our program has grown to include six themes: Animals & Their Senses, The Role of Predators in Nature, Wildlife & Wetlands, The Role of Fire in the Ecosystem, Leave No Trace, and Wildlife in Winter.

The programs are primarily designed to help elementary students (grades K–6) appreciate and understand Alaskan wildlife and ecosystems, as well as to help them develop safe outdoor skills. All units are done outdoors on Refuge sites, and are cross-referenced to Kenai Peninsula Borough science and social studies curriculum requirements.

If you are an elementary teacher interested in our Environmental Ed programs, we invite you to book a field trip for your students. If you are a parent who would like your child to participate in a Refuge environmental education program, contact your child's teacher and encourage the teacher to make a field trip reservation. Volunteers are always needed to help chaperone field trips and you will have as much fun as the kids have. If you are a student who wants to go on a field trip, let your teacher and parents know. For more information on the Kenai National Wildlife Refuge Environmental Education Program, call us at 262-7021.

Candace Ward has been a park ranger at the Kenai National Wildlife Refuge for more than 15 years. She coordinates Refuge visitor service and education programs. Stephanie Smith is a conservation associate, who has been actively working with students in Refuge environmental education programs since March 2000.

A historic cabin raising party

by Gary Titus

While hiking on the Kenai National Wildlife Refuge, you may have come across the remains of an old log cabin and wondered about its origins. Perhaps you examined the craftsmanship of the log corners or were curious about the men who built them and how they lived. Many of these cabins are reminders of the men who helped create the Refuge we enjoy today.

The Kenai National Moose Range, which is now the Kenai National Wildlife Refuge, was established by President Roosevelt on December 16, 1941 to protect the natural range of the giant Kenai moose on the Kenai Peninsula, Alaska. The concept of a moose range probably originated about 1897 with the arrival of big game hunters. One of the first (and most articulate) hunters was Dall De Weese from Canyon City, Colorado. He wrote magazine articles about his hunting adventures, gaining the attention of sportsmen from all over the world and putting the Kenai moose on the map.

With the increasing numbers of hunters traveling to the Kenai Peninsula for big game, the need for guides became essential. In 1908, the Department of Interior, District of Alaska, passed a law requiring the employment of guides for all nonresident hunters on the Kenai. These big game guides guided sportsmen from all over the world, who returned home to write books and articles about their experiences. These sportsmen were the first to see the need for protection of the Kenai's vast game lands, and they raised a call that was heard around the world.

The first big game guide on the Kenai was Andrew Berg, who arrived on the Kenai around 1889 from Finland. Andrew Berg settled in the Tustumena Lake region, where he prospected for gold, trapped, guided, and for a short time was employed as a Territorial Game Warden. During the summers from 1924 to 1936 he worked for the US Fish and Wildlife Service protecting salmon and seals around the Cook Inlet area. In 1902, he built his first known cabin, which still stands today and is listed on the National Historical Register. In 1935, he built the Homestead Cabin, which was his last cabin, before his death in 1939. This spring the Kenai Refuge decided to move the Homestead Cabin from the shores of Tustumena Lake to the Refuge Visitor Center so that it can be used for interpretive purposes.

In July of 2000, Refuge staff with the help of volunteers and Youth Conservation Corps high school students dismantled the cabin and moved the pieces to the Refuge Visitor Center, where it will be restored to its original condition along the Keen-Eye Trail near the parking lot.

To put the cabin back together, we are holding a cabin raising party and everyone is invited. This event will take place on Saturday, September 9, 2000 at 11am at the Refuge Visitor Center. The cabin's foundation is finished and the logs are ready to be laid. Come and watch, or join in fitting the old logs together the way they originally were, chinking between the logs with moss, or taking photographs to document the reconstruction. There will be plenty to do as the old cabin slowly comes back to shape. I will give an interpretive talk about Andrew Berg and the history of log cabins on the Refuge. In keeping with the tradition of a cabin raising, please bring a favorite potluck dish for lunch. Wes Roberts will provide music for the event. If you would like more details on this project, call me at 262-7021, or Michelle Brown, vice-president Friends of the KNWR, at 262-6377.

Gary Titus is the Wilderness Ranger and Historian at the Kenai National Wildlife Refuge. Previous Refuge Notebook columns can be viewed on the Web at http://kenai.fws.gov.

Lightning is rare but important in Kenai Peninsula fires

by Ed Berg

As a born-and-raised Midwesterner, I love a good thunderstorm with lots of lightning, especially at night. On the Kenai Peninsula I miss these grand pyrotechnic shows and that mixture of awe, terror, and relief, when you say, "Boy, that one was close!!"

On a recent Saturday (Aug 19) we had just such a display as a thunderstorm rolled up the central Peninsula, crossing Tustumena Lake and passing over Sterling. Mark Wegner was fishing at Nikolai Creek and saw lots of lightning on both sides of Tustumena Lake. Two fires were reported the next day, which were probably caused by lightning strikes. One fire was just south of Windy Point on Tustumena Lake, and the other was on the East Fork of the Moose River. We are monitoring these spots, and no smoke has been seen at the Tustumena Lake site for a week. Local pilots did report smoke at the East Fork site last weekend, however. The burned areas are less than an acre. Both fires are in the zone of limited suppression, so we would not extinguish them unless they threatened to move toward populated areas.

I have always been puzzled about the lack of lightning and lightning-caused fires on the Kenai. The vast majority of our wildfires can be clearly traced to human beings (campfires, cigarettes, etc.). Jim Peterson at the Alaska Division of Forestry in Soldotna estimates that maybe one fire per year might be traceable to lightning, although he did recall one thunderstorm in the late 1980's which started seven fires simultaneously in the Caribou Hills.

The Kenai's general lack of lightning contrasts strongly with Interior Alaska, which can have several thousand lightning strikes and dozens of fires in a single thunderstorm. Alaska Fire Service (AFS) data for the Interior, for example, show an average of 26,000 cloud-to-ground lightning strikes per year during the period 1986-97, most occurring between four and six pm during late June and early July.

The electrical impulses from lightning strikes are recorded by electrical sensors at nine stations in Alaska, mostly north of the Alaska Range, and AFS prepares daily lightning maps during the summer. Unfortunately, it takes quite a blast on the Kenai to reach the sensors. When I checked with AFS about our Aug 19 lightning strikes, they hadn't recorded anything at all. If we had more lightning, I was informed, they would put some sensors down here, but they want the biggest bang for the buck, one might say.

So, why don't we have more lightning on the Kenai? I discussed this with Dorte Dissing, who is doing a graduate thesis at UAFInterior Alaska, orographic effect, Swanson River Road, on lightning and the boreal forest in Alaska. She pointed out that to get a good thunderstorm going, you need a very unstable airmass that would rise "forever" if given the chance. You also need some kind of triggering mechanism to set off the instability and get the air churning. The problem in coastal areas like the Kenai is that most marine air masses are very stable, and do not want to rise. In coastal areas it is hard to heat up the ground enough to get the air moving upward by convection, because of the cool ocean air and the extensive cloud cover. Furthermore, the coastal air aloft is much warmer than in the Interior, and it makes a ceiling that prevents any hot air from continuing to rise, because air only rises until it is no longer warmer than the surrounding air.

In the Interior there are triggering mechanisms like thermal troughs and high-pressure ridges, which are uncommon along the coast. On the Kenai the main triggering mechanism is probably the "orographic" effect of the mountains: when a moisture-laden airmass approaches the Kenai Mountains from the west, the flow of air lifts it upwards and cools it. The moisture condenses and we get rain, at least. If the lift is high enough, the water will freeze and ice crystals (and hail) start forming. Ice crystals are necessary to get the separation of electrical charge required for lightning. Orographic lifting thus explains why the big cumulus clouds and (rarely) thunderstorms and lightning usually form near the mountains and not over the Inlet or Kenai-Soldotna.

At the Kenai Refuge, we are starting to rethink the role of lightning in the Peninsula forests. In 1998 we pulled a nine-meter core of sediments from a lake along Swanson River Road. Dr. Scott Anderson of Northern Arizona University has been analyzing the charcoal in this core, in one-centimeter slices. When he is finished, we will have a 13,100-year record of

fire in this drainage, which essentially covers the time since the retreat of the last major glaciation. We can see already that there were fires during the tundra period before spruce arrived 8000 years ago, as well as numerous fires once spruce was established. It is highly unlikely that the native people caused many (if any) of these fires, so lightning as a fire source becomes important on a timescale of decades and centuries.

If you would like learn more about lightning in Alaska, check out Dorte Dissing's website at http://www.dverbyla.net/gradstudents/dorte.html

Ed Berg has been the ecologist at the Kenai National Wildlife Refuge since 1993. . Previous Refuge Notebook columns can be viewed on the Web at http://kenai.fws.gov.

Orbital cycles make glaciers come and go

by Ed Berg

The arrival of Fall reminds us once again of the Cycle of Seasons, and that indeed we live our lives in accordance with a great variety of cycles. Some short-term cycles, like those of eating and sleeping, are hard to avoid, but others are less noticeable, their duration being longer. I usually don't know where today is in the 29.5-day lunar cycle, but I do know that this cycle brings two periods of higher high tides, as well as a Full Moon with barking dogs and restless sleep. Medics tell me that a Full Moon also brings more visits to the Emergency Room, more murders, and more babies being born.

Here in the Far North the seasonal cycle strongly structures the life of every creature; many insects overwinter as eggs or larvae, bears hibernate, humans bundle up, and plants shut down photosynthesis. The seasonal cycle is caused by the tilt of the Earth's axis of rotation at 23.5° from the axis of its orbit around the Sun. In the winter the axis of rotation tips away from the Sun, and the Sun's rays hit the northern latitudes at a low angle. In the summer the Earth is on the opposite side of the Sun, with the axis of rotation tipped toward the Sun, and the Sun's rays hit at a high angle.

There are, however, longer cycles in this Earth-Sun story, which affect the comings and goings of great continental glaciers. These are long-term cycles in the Earth's orbital characteristics (parameters). The spinning Earth bobs and precesses like a child's top. The angle of tilt varies from 22° to 24.5° in a cycle of 17,280 years. The axis itself precesses in a clockwise direction in a cycle of 25,920 years. These two motions combine to return the axis to the same starting point on a cycle of 41,000 years. When the axis is tilted at 24.5°seasonally is greatest: summers are warmest, and winters are coldest.

The Earth travels in a slightly elliptical orbit around the Sun, with the Earth being somewhat offset from the center of the ellipse. On a scale of one year this offset is hardly noticeable; the Sun is closest to the Earth on January 4, but this doesn't do a whole lot of good for handwarming at that time of year. In time, however, this closest point (called the "perihelion") migrates later into the year, making a full swing around the calendar in 20,293 years. When perihelion is in the summer, it makes summers warmer and winters colder, just like increased axial tilt.

You may not have noticed that periodically the Earth's elliptical orbit flattens out a bit. This allows the Sun to warm the Earth more effectively, because the Sun is closer for a longer part of the year. This cycle takes 100,000 years, and it has been described as the real "pacemaker of the ice ages," because it has the strongest effect on the Earth's temperatures.

When the cycles of axial tilt, perihelion, and ellipticity come together, they can warm up the Northern Hemisphere very effectively. This happened "recently" over several millennia, with the warmest time being about 9000 years ago. At that time axial tilt was near its maximum at 24.2°, ellipticity was at a local maximum, and the Earth was closest to the Sun on July 30. Summers were 5°F warmer, and the glaciers pulled back rapidly.

It took the last great ice age about 50,000 years to build up, and only 6-7,000 years to fall apart. At the ice age maximum 20,000 years ago, the Cook Inlet Basin was almost wall-to-wall ice, from the Alaska Range to the Kenai Mountains, with only a narrow string of glacial lakes stretching from Sterling to Anchor Point. By 18,000 years ago the ancestral Kenai River was major glacial sluiceway, but it flowed southwest from Sterling through Headquarters Lake to Kasilof and Cohoe, rather than through Soldotna and Kenai. At 16,500 years ago the city of Kenai was at the foot of a marine tidewater glacier, whose sediments formed the lower layer visible in the bluff below the Senior Citizens home. By 13,000 years ago Hidden Lake and Paradox Lake on the Kenai Refuge were open water, with glaciers at one end. The last ice age thus collapsed quickly, like a house of cards, once the orbital cycles lined up and the heat increased.

The "astronomical theory of ice ages," which I have outlined above, was primarily developed by the Serb mathematician Milutin Milankovitch during the 1910's to the 1930's, including a stint of quiet working time as a prisoner-of-war in 1914. At first, most geologists generally didn't take the theory seriously because there was no way to verify it. There were no good temperature records, and there were no accurate

ways of dating geologic deposits, even if you could tell at what temperature the deposits were formed.

By the 1970's, however, both dating and temperature technologies had improved. In 1976 two sediment cores were examined from the southern Indian Ocean which had a continuous 450,000-year record of ocean floor mud accumulation. Fossils in the sediments were analyzed layer by layer for both age and temperature, and a graph was prepared which showed major warm periods every 100,000 years, and minor warm peaks at intervals of 41,000, 23,000 and 19,000 years, just as Milankovitch had predicted. Since that time interest in geologic cycles has sky-rocketed, and Milankovitch-type cycles have now been identified in rocks hundreds of millions years old, as well as in sediment cores from other parts of the world. Most geologists today accept Milankovitch's orbital parameters as the basic motor of the ice ages, recognizing that the motor is governed by a variety of other factors, such as the position of the continents and the flow of ocean currents.

Studying cycles has been a hobby of mine for many years, with a certain ebb and flow, and I will be teaching a short course on the natural cycles at the Kenai Peninsula College, starting next Tuesday, Sept 19. It will meet for four Tuesday evenings, and have a field trip to Kachemak Bay on Saturday, Sept. 30. Topics will include the tides, orbital cycles, and geologic cycles in Kenai Peninsula rocks. Kenai Refuge studies of tree-rings, bark beetles, the hare-lynx cycles, and small mammal cycles will also be presented.

Ed Berg has been the ecologist at the Kenai National Wildlife Refuge since 1993. Previous Refuge Notebook columns can be viewed on the Web at http://kenai.fws.gov.

Kenai Refuge open house events

by Candace Ward

The Kenai National Wildlife Refuge will host its annual Open House on Saturday, September 30 from 11 - 3:00 p.m. This year's theme, Wild About Wilderness, celebrates the 20th anniversary of the establishment of 1.35 million acres of designated wilderness on Kenai National Wildlife Refuge. Exhibits and programs will illustrate how the Refuge wilderness lands benefit the people and wildlife of the Kenai Peninsula. **Time Specific Events include:**

BBQ Lunch at noon - Come enjoy hot dogs, beans, and salad. Meet refuge staff, volunteers, and friends. Meet our Refuge Manager Robin West, new Assistant Manager Jim Hall, and volunteer coordinator Amy George. The lunch is organized courtesy of Refuge administrative staff - Pam Ables, Sandy Groth, Karen McGahan, and Brenda Wise.

Visit with live raptors from the Anchorage Bird Treatment & Learning Center at 11:00-2:00 p.m. Our bird guests will be a golden eagle and peregrine falcon.

All Day Events - 11:00 a.m.-3:00 p.m.:

Kid's Activities - Go on a wilderness scavenger hunt and win fun prizes! Hosted by Ranger Michelle Ostrowski and conservation associates Carlie Henneman and Stephanie Smith.

Meet the Kenai National Wildlife Friends Group and learn about their upcoming community events. Find out about their new Sponsor-A-Refuge Wildlife Species Program.

Andrew Berg Cabin - See the historic cabin that community volunteers and Refuge staff relocated from Tustumena Lake in the Andy Simons Wilderness Unit to the Refuge Visitor Center. Backcountry Ranger Gary Titus will host the cabin site and share updates on the project.

Wilderness: Penthouse for Fish - Come take a mysterious peek at the underwater world of fish. Find out how fish benefit from wilderness. Hosted by biologist Mary Price.

Wilderness Benefits Wildlife - See how wilderness helps brown bears, wolves, lynx, trumpeter swans, caribou, Dall sheep, and mountain goats. Hosted by biologists Sue Schulmeister and Rick Ernst.

Fire in Wilderness - Learn how wild fire is managed in Refuge wilderness. Hosted by Fire Management Officer Doug Newbould and fire management staff.

Wilderness Benefits the Kenai Peninsula - Discover how wilderness contributes to the quality of life for Kenai Peninsula residents and what we can do to protect and preserve wilderness. Hosted by Rangers Candace Ward, Rick Johnston, and Bill Kent.

Wilderness Travel - Learn to travel in Refuge wilderness safely and legally using your feet, horses, and canoes. See how to organize a survival kit and use outdoor gear. Hosted by refuge staffers Mark Wegner, Dave Kenagy, Greg George, and Chris Johnson.

All events take place at the Kenai National Wildlife Refuge Visitor Center on Ski Hill Rd., one mile south of Soldotna. If you have questions, please call 262-7021.

Candace Ward has been a park ranger at the Kenai National Wildlife Refuge for more than 15 years. She coordinates Refuge visitor service and education programs. Previous Refuge Notebook columns can be viewed on the Web at http://kenai.fws.gov.

A Kenai experience

by James Hall

Few words can express the feelings that accompany fulfilling one's life dream. Standing on the boardwalk overlooking the Kenai River, watching moose browse alders, seeing eagles feed in the trees overhead brought me to the realization that I had indeed met one of my life goals—coming to Alaska! When I was four years old, my parents spoke of moving from Georgia to Alaska to homestead. They never did, but I wish they had, for coming here is a bit like coming home for me.

My name is Jim Hall, and I am the new Assistant Manager for the Kenai National Wildlife Refuge. I just moved my family 4,998 miles from Natchez, Mississippi where I was the Refuge Manager for the St. Catherine Creek NWR.

Many people ask how I ended up working for the U. S. Fish & Wildlife Service. Well, the story goes like this: When I was 12 growing up in the north Georgia mountains, white-tailed deer were a scarce commodity. My Father routinely sacrificed his weekends in the fall to drive my brother and myself 32 hours south to hunt on the Piedmont National Wildlife Refuge. One day, while on a bow hunt at Piedmont, a Federal warden stopped and checked our permits and license. For me, growing up where squirrels, quail, and rabbits were the only game, the people who protected our few deer did a very special job. (Deer were re-introduced to Georgia in the 1950's). After the warden drove off, I asked my Dad, "Does he get paid to do that?" After an affirmative reply from my Father, my mind was set on my future career!

A decision that affects an entire family rarely suits all members of the family, especially when it involves a move. My eldest daughter Danya (age 16) cried for weeks after being made aware of the move. She suffered most by losing her friends, her car, her dog, and her cats. The car was given to friends who did not have one, the dog and cats to other friends. Thirteen days on the road, and we've been here three weeks now. This past weekend she spent the night with her new friend Fiona on Friday night and with another new friend Haylee on Saturday night! Ahh! The resilience of youth!

My wife Elaine seems to love it here so far, as does my youngest daughter Kit (age 13). My wife, being both a naturalist and a poet, expressed it this way:

> There is a razor-sharp beauty to Alaska: it flays self-illusions and pierces the soul with absolute wonder and primal fear. 'Survival of the fittest' is no trite phrase here. Alaska will cradle you in one moment and kill you in the next. I love the honesty of it; each and every creature is treated as an equal. Man does not reign supreme in this land, yet neither is he an inferior, he simply IS. What an elegant simplicity!
>
> I am in awe of this land. I am intoxicated and infatuated. I am humbled by the majesty of the volcanic mountains covered in ice; cognate of the paradox. I am bewitched by the shifting colors of the Inlet waters. I am spellbound by the rapidity with which the chromatic fall foliage replaces the variegated greens of summer. I have entranced myself, for Alaska neither needs nor seeks my appreciation or approval. I like that too.
>
> Rusted out vehicles are herded together in fields of fireweed. Tar-papered and plywood-patched cabins peek out from behind pristine stands of aspen and spruce. Streets weave a drunken line through towns that end as abruptly as they begin. This is Alaska as well. People talk less, listen more, and learn much. The ones that choose to stay are survivors of a different sort, private and personable; independent and generous; loud with laughter and quiet in spirit, tempered by an environment that does not tolerate fools. I have found Valhalla.
>
> Should I do nothing more for the rest of my life but stare out my window at the view before me, I would never be bored, for peaceful urgency ripples the air. The sea alternately caresses and beats the rocks on the beach, giving birth to a

coarse-grained black sand that bespeaks of ancient molten-formed parents. The constantly shifting plates here remind one of how young this land really is like a teenager unsure of her identity. Alaska is slipping and sliding towards adulthood. Earthquakes are common, though rarely noticeable. Glaciers flirt with the land, seductively gliding forward to touch the base of the mountains, then shyly retreating back to the safety of their icefields. Centuries-old conifers masquerade as youngsters, their slender girths and tapering crowns disguising their immense age.

Alaskan life is precarious and precious, the fertile summer months are short and intense; the brutal winters are long and unforgiving. The motto here should be 'Carpe Diem,' or perhaps even more appropriately, 'Eat, Drink, and be Merry,' for there will be a tomorrow in which you will surely die. Delusions and illusions do not survive the untarnished truth of Alaskan life. My spirit rejoices in this straightforwardness.

Understand, we have not yet experienced an Alaska winter! However, I doubt our feelings will change much since we like cold weather, and we're glad to escape the 90° to 107° summers in Mississippi!

Since arriving, I have come to realize that just about everything that I have ever heard about the Kenai is true. And I have also come to appreciate the Refuge as a complex institution and ecosystem. The issues range from fisheries, to subsistence, to brown bears, to oil & gas exploration and development. The glory of flying over the Kenai mountains, watching sheep and goats scale near vertical slopes with ease, seeing a half dozen bald eagles in a brief boat trip down the river, all of these experiences combine to bring about a sense of awe. My fifteen years of federal service has been well spent, for it got me the job that brought me to the Kenai.

Since I have been in the State, I have noticed several things unique to Alaska. First, people precede their comments with, "Hi, my name is ___, and I've lived in Alaska ___ years." This qualifying statement, which gives the speaker credence to those assembled, is interesting. I wonder how it got its origin? So, here goes! "Hi, my name is Jim Hall, and I've lived in Alaska almost one month." Before you judge, understand that I know I'm new, and I don't understand the issues yet, but I'm learning, and hopefully I can bring along a different perspective.

Another thing I've learned about this area is that the people here are just 'nice folks.' My family and I are still living in a hotel waiting to close on our new house. We chose the Clam Gulch Lodge as our 'home,' and I have been very pleased with the reception my family and I have received so far. The people there have gone out of their way to help us, and have just been super. This helpful nature has been reflected by the folks in Soldotna, Sterling, Kenai, Kasilof, and Ninilchik as well—all 'Nice Folks.'

The Kenai NWR stretches almost from one end of the Peninsula to the other, with almost two million acres. Approximately 500,000 people per year use the Refuge for hunting, fishing, hiking, and wildlife observation. I know I am glad to be here, and I look forward to serving the Kenai Refuge, the Kenai Peninsula, and the people of Alaska.

Jim Hall is the new Assistant Manager for the Kenai National Wildlife Refuge. Previous Refuge Notebook columns can be viewed on the Web at http://kenai.fws.gov.

Alaskan firefighters fight fires in lower 48

by Doug Newbould

Now that the 2000 wildfire season is over and most Refuge firefighters have returned to Alaska, I thought it would be interesting to share some of our experiences. Like most firefighters in Alaska and throughout the United States, we had many opportunities to travel around the Rockies and the Great Basin this summer—chasing wildfire. I think I can safely speak for my coworkers, when I say that this fire season will long be remembered for its duration, its coverage and its intensity.

It started back in early June, when the first three Refuge firefighters headed for New Mexico. Dave Reese went to the Viveash Fire near Pecos as a helicopter crewmember. After a day in New Mexico, Dianne MacLean was ordered as a helicopter manager to the Outlet Fire on the north rim of the Grand Canyon in Arizona. Alicia Duzinski went with a helicopter module (team) to the now infamous Cerro Grande Fire at Los Alamos, New Mexico. After that incident, many in the fire management community felt the Los Alamos fire would have a profound and long-lasting effect on us all. Little did we know that it would be shoved to the backs of our minds, as the most devastating wildfire season in decades took off like a rocket.

In July and August, fires began popping up in the central and northern Rockies and the Great Basin. Refuge firefighters Anthony Snow, Mike Woods, Brandon Miner, Candy Godin and Jon Papendieck were dispatched to fires in Nevada, Colorado, Wyoming, Idaho and Montana. Anthony was ordered as a helicopter crewmember and Mike went out as a medical unit leader trainee. Brandon, Candy and Jon joined firefighters from the Chugach National Forest on a 20-person hand crew. I was sent to the Helena National Forest as a felling boss (a crew boss for tree feller/sawyers). Larry Adams (our recently retired Refuge fire management officer) returned to active duty in Idaho as a dispatch recorder and resource unit leader. Dianne, Alicia and Dave returned south for their second firefighting tour of the season.

After short trips home to rest and recuperate, all of us returned to Idaho and Montana in late August and early September. Anthony is still in Montana, helping folks on the Lewis and Clark National Forest complete fire rehabilitation projects. All totaled, eleven Kenai National Wildlife Refuge employees logged over 4400 hours fighting fire in the Lower 48 this year. We worked on more than two dozen wildfires in six states. All worked hard long shifts for two weeks at a time in hot weather, slept on the ground and came home with great performance evaluations. I am proud of them. Despite the hardships, I know all of us gained valuable experience. And we will be better prepared for wildland and prescribed fire incidents in Alaska because of it.

One of the reasons why the 2000 fire season was so unusual is because there was no let-up, no green-up and no intermission. From May to October, the battle was constant. Usually, there are two distinct fire seasons in the West: the early season (between Break-Up and Green-up when forest fuels and the weather are dry), and the late season (from August to October when grasses cure and the days are long and hot). We never got a break. In my 25 years of firefighting, I have never seen such extreme fire weather coupled with drought-stricken forests. It was a recipe for disaster, and we watched it bake.

I was at the Yellowstone fire in 1988. This was worse…much worse. In August there were so many large fires burning in Idaho and Montana, there were not enough overhead teams and firefighters available to attack every fire. Some fires burned for days before anyone could get to them. The national wildfire organization was stretched so thin, that the Army, the Marines, the National Guard and firefighters from Canada, Australia and New Zealand were called in. I actually worked for a division supervisor from Tasmania. I enjoyed working with him and it was a great experience, but it concerns me that we are unable to handle our own wildfire incidents in America. To my knowledge, this has never happened before. We wrote the book on wildland firefighting. The rest of the world looks to us for fire management expertise.

It makes me wonder how we will manage wildfires in the years ahead. Ten years from now, will we look back at Yellowstone 1988 and say it was merely the harbinger, the messenger of things to come? Forests throughout the West have become unmanaged tinder-

boxes, choked with brush and doghair stands of suppressed conifers. It is entirely possible that we have not yet seen the worst fire season—the potential remains. Nationally, we will have much to discuss in the months ahead. How can we prevent another Cerro Grande? What can we do to limit the potential of wildland fires in America? How can we supplement the national fire organization during extreme fire seasons? It's going to be an interesting winter…

Doug Newbould is the Fire Management Officer at the Kenai National Wildlife Refuge. Previous Refuge Notebook columns can be viewed on the Web at http://kenai.fws.gov.

Bark beetles hit west side of Cook Inlet in the 1870-80's

by Ed Berg

In late July 1899 the steamship Geo. W. Elder of the Harriman Alaska Expedition sailed into lower Cook Inlet, as far north as Iliamna volcano. The Expedition was financed by railroad magnate Edward H. Harriman and had recruited some of the top scientific and literary talent of the day. The goal of the Expedition was to collect as much data as possible on the natural history of Alaska and its native inhabitants. Nature writers John Burroughs from New York State and John Muir from California were the grand old men on board, as was William Dall (as in Dall Sheep) who was renowned as the first American naturalist to study in Alaska. Also on board was a young photographer Edward S. Curtis, later to become famous for his striking portraits of American Indians throughout the West. Mammalogist C. Hart Merriam, head of the U.S. Biological Survey, was chief of the 25 scientists recruited for the two month trip.

The Harriman Alaska Expedition collected great quantities of specimens, photos, artifacts, and interviews, and ultimately published 12 volumes of technical studies. Homer writer Nancy Lord has recently revisited the Expedition in her delightful book Green Alaska: Dreams from the Far Coast (1999, Counterpoint), when she and her fish tendering partner Ken Castner retraced the Expedition's route along the Alaska Peninsula and the Aleutians.

Nancy Lord points out that when the Expedition cruised through lower Cook Inlet extensive tracts of dead forest were noticed. John Muir wrote, "On the stratified deposits (Tertiary) on the west side of Kachemak Bay and Cook Inlet considerable areas were covered with dead forest, said to have been killed by showers of ashes and cinders…from Iliamna; some say by ordinary forest fires." Having survived the spruce bark beetle outbreak of the 1990's, as well as various eruptions of the Cook Inlet volcanoes, Nancy rightly balks at the suggestion that volcanic ashes and cinders, or fires in the damp coastal forests, might be the sources of mortality in these dead forests. She suggests that Expedition naturalists were observing the results of precisely the same kind of spruce bark beetle outbreak that we know so well today.

My curiosity was more than piqued when I read this observation and discussed it with Nancy Lord. At the Kenai Refuge we have spent several field seasons collecting tree-ring (dendrochronology) evidence of past spruce bark beetle outbreaks. We have looked at 16 sites from Seldovia to the Swanson River Oilfield, and east to the Mystery Hills and Cooper Landing. In the northern sites we can see regional beetle outbreaks in the 1810-20's, 1900-1910's, and 1970's. The southern sites were heavily hit in the 1870-80's, especially the north side of Kachemak Bay.

Several years ago we discovered William Langille's 1904 report on the forest conditions on the Kenai Peninsula. (Langille was the right-hand man in Alaska of Gifford Pinchot, Teddy Roosevelt's architect of the US Forest Service in 1905-06. Langille became supervisor in 1905 of what today is called the Tongass National Forest.) In his 1904 report Langille described the standing dead forest with 40-100% mortality between Coal Bay (Homer) and Anchor Point. In 1994 we studied a clearcut on the west side of Homer in great detail, cutting more than 500 slabs from stumps. Virtually every slab showed a major growth spurt (wider rings) in the early 1880's, due to a severe thinning of the forest canopy which "released" the survivors from competition. The fact that Langille described the dead trees as "standing" ruled out blowdown by wind as the mortality agent in this stand and left spruce bark beetles as the most plausible candidate.

The Harriman Expedition report of dead forest on the west side of Cook Inlet raised the possibility of a second historically confirmed dead forest. But could we find it? No specific location was reported, beyond being in the vicinity of Iliamna volcano. Nevertheless, if this was a beetle-kill event, it was probably a widespread regional event on the west side of the Inlet, just as it is today, and as it was on the southern Kenai Peninsula side in the 1870-80's and 1990's. Probably any forest from Kamishak Bay to Iliamna to Redoubt volcano should show evidence of this outbreak.

I decided to try Polly Creek, north of the Crescent River and Tuxedni Bay. Conversations with loggers and local setnetters indicated that this area possessed abundant mature spruce forest with trees old enough to have a good tree-ring record of 19th century

growth. On July 10th Refuge Biotech Doug Fisher, forest ecologist Andy DeVolder and I flew over to the Polly Creek beach, where we met John Swiss who homesteaded a setnet site here in 1949. John and his sons Tyler and Jack described their extensive efforts to clear fire-defensible space around their buildings, because the surrounding spruce forest was almost 100% beetle-killed. For the next three days we cored trees with increment borers to sample the tree-rings, collecting 120 cores, with the oldest dating back to 1696.

Back in our lab at Refuge Headquarters, Biotechs Candy Godin and Archer Larned set to work measuring the tree-ring widths in our core samples. When we analyzed all these measurements we could see a general period of accelerated growth from 1870 to 1890, especially in 1878-1880 when 24% of the trees initiated a growth release. With almost a quarter of the trees releasing in this three-year period, we can infer the occurrence of a major thinning of the forest canopy, i.e., substantial death of large overstory trees. When the Harriman Expedition in 1899 observed dead forests on the west side of Cook Inlet, they were presumably observing this mortality, which had peaked 20 years earlier, just as it had peaked earlier on the Kenai Peninsula side of the Inlet.

Polly Creek is the only site we have examined on the west side of the Cook Inlet, but it tends to confirm our view that the present bark beetle outbreak is basically a replay of the of the 1870-80's outbreak. Both outbreaks have affected hundreds of thousands of acres of spruce forest on both sides of the Inlet, and the outbreaks have lasted ten years or more in a given area. In both outbreaks, sites with sunny southern exposures have been hit the hardest, presumably due to drought-stressed trees. Conversely, sites on cool, steep north-facing slopes have experienced less beetle kill, or in the case of Neptune Bay, they escaped the 1870-80's outbreak altogether.

The comments, however brief, of the Harriman Expedition writers about the dead forests in Cook Inlet have added another valuable piece of information to the spruce bark beetle story of southcentral Alaska. I would be very interested in hearing from readers who might know of other such historical reports of dead forests. This might take the form of old letters, newspaper articles, maps, or photos. The spruce bark beetle puzzle is slowly coming together, but we need more pieces!

An excellent collection of photos from the 1899 Harriman Expedition can be viewed on the web at http://128.95.104.14/index.html (University of Washington archives).

Ed Berg has been the ecologist at the Kenai National Wildlife Refuge since 1993. He can be reached at Refuge Headquarters at 262-7021. Previous Refuge Notebook columns can be viewed on the Web at http://kenai.fws.gov.

Future archeologists explore Kenai Peninsula's past

by Rachel Belouin

Within the Kenai National Wildlife Refuge, just a stone's throw away from combat fishing on the Russian River, a group of young campers aided by professional archeologists spent the summer learning the stories and history of the Dena'ina (Athabaskan) and Kachemak Tradition (Eskimo) peoples. This group of campers from the Kenaitze camp in Cooper Landing spent three weeks practicing the ways of archeologists as they uncovered artifacts and structures that belonged to early Russian River fishermen five hundred to two thousand years ago. This past summer I had a chance to spend a day with this group of campers and their counselors.

When I first arrived at the site, several hundred yards back from the bank overlooking the Kenai River, I found a hard working crew of campers and archeologists. Some were in the excavation pit, digging and scraping soil and rock with trowels into blue plastic buckets. The pit itself was not large, but separate rooms were distinguishable. Other campers were dumping the scraped earth into a large screen and sifting through the blackened soil looking for the smallest artifacts, while several campers and counselors worked on bagging and labeling their new finds. I was greeted with excited smiles and hellos as the campers came to tell stories of their different discoveries. Debbie Corbett, project leader and US Fish and Wildlife archeologist, patiently guided me through the project's history and accomplishments. This particular endeavor began three years ago when the Kenaitze camp for native children and the US Forest Service started a partnership to involve native children in activities within the Chugach Mountains and surrounding areas. Native Kenaitze children are given first preference to be camp participants, but Corbett assured me that no one has been turned down and that there has been a good mix of native and non-native kids attending the camp. Camper ages range from 12 to 18 years old, and sometimes a bit younger. For three weeks the campers are exposed to cultural experiences, learn about natural resources, and participate in an overall broad resource experience. Approximately half of the campers return each year.

As part of their work, the campers had to dig, record, sift, and ensure that all artifacts were accurately recorded. The campers also spent time working at the Kenaitze Tribe interpretive site where they made a catalog of artifacts with labels and full descriptions. The campers learned how to recognize artifacts and seemed very adept at finding and identifying fragments of bone. They also became skilled in recognizing changes in soil color and texture that indicated postholes and fire pits. As I watched the junior archeologists scurrying about the dig site, I was impressed by how assured the kids were of their tools and knowledge of how to properly dig and sort through the dark black soil. They often interrupting my conversation with Corbett to present a possible artifact, some smaller than their tiniest finger. Others were hollering to proudly point out where they had discovered the remains a fire pit and to show their knowledge that the dark black soil color was caused by charcoal. According to Corbett, three levels have been identified and dated within the pit, ranging from about 500 to 2000 years in age. The first level is 500 to 800 years old and has revealed copper, obsidian, and black slate beads, as well as old fireplaces and postholes that Corbett believes were part of a structure for smoking and drying fish.

The second level, 1000 years old, has yielded a lens of black charcoal soil, boulder spalls for processing fish, fire-cracked rock, scrapers, and worked slate. One boy in his second year on the dig explained that fire-cracked rock is rock which was heated up in fires and then put in baskets to heat food or to use for steam baths. Level two has also revealed bones, most of which were burnt. A lab in Vancouver has identified these bones and the kids reported excitedly that some of the bones were from two sizes of salmon, rockfish from salt water, various ducks, cormorants, and marmots. Corbett believes that level two may mark the Dena'ina's first arrival on the Peninsula.

The third level, where the campers were currently digging, has turned up numerous artifacts, including net sinkers which are characteristic of the Kachemak Tradition people. That evening, well after I had left the dig, Corbett and several of the campers excitedly sought me out to show me a spear point that they had

found late that same afternoon. It was six inches long and made from ground slate. I was thrilled to hold it and I could tell by the brightness of the eyes around me, that I was not the only one feeling a connection with a long ago time. According to Corbett this artifact, very characteristic of Eskimo and Kachemak peoples, gives every indication that this was a 2000-year-old Kachemak single family home, not a potlatch or meeting house as originally thought.

Part of the learning process for the campers and archeologists is the time spent back at camp with discussions, questions, and making crafts with native tools and methods. Informal discussions with the kids lead to many questions about the Dena'ina and their way of life and beliefs. Trade and connections between the different peoples have sparked great interest, as have discussions about rivers and floods.

Not only were the kids digging up artifacts, they were also making some of their own. Using traditional native methods and hand tools the campers created jewelry and learned how to start fires with bow drills. I watched the kids sitting with stone tools hammering and chipping away, laughing and enjoying their chance at creativity in the ancient way. The kids were also required to contribute to the final yearly report on the dig. Some entries included drawings, stories and poems. Corbett enjoyed pointing out the quality of imagination and talent with which each camper had engineered his or her project.

Though I spent only a few hours with the campers and archeologists, I went home that night with a growing awareness of the Alaska I had come to enjoy during my summer's work. I have begun to learn the stories of the people that have made the Kenai Peninsula home. In spending time with the campers I realized that I had been watching some of them learning firsthand about their families and ancestors. It was as if they were opening up scrapbooks and picture albums for the first time. For those campers and archeologists with no family ties, they too found inspiration in the thrill of discovery and the adventure it provided. I remember well seeing the campers and waving good-by to them later in the summer, as they left on their last day, bound for Homer to bring their artifacts, cataloged and labeled, to the Pratt Museum for all of us to see and enjoy in the future.

Rachel Belouin is a senior at the University of Massachusetts majoring in outdoor recreation. She participated as a volunteer Student Conservation Association Resource Assistant on Kenai National Wildlife Refuge during the 2000 summer season. Previous Refuge Notebook columns can be viewed on the Web at http://kenai.fws.gov.

Waterfowl hunting on the Kenai National Wildlife Refuge

by Rob Barto

As the snow starts to fly and the weather turns foul, it's time to dust off the over-under, mend the decoys, practice calling, start retraining the faithful Lab, and get out to enjoy some of the excellent waterfowl hunting opportunities on the Kenai National Wildlife Refuge. The Refuge is home to some of the finest duck hunting available by vehicle or short boat ride on the Peninsula. The Chickaloon River flats, Tustumena glacier flats, and the inlet and outlet of the Kenai River at Skilak Lake can all provide the diehard waterfowl hunter with ample places and opportunities to enjoy the last hunt of the year.

The toughest place to access is the Chickaloon River flats located on the northern edge of the Kenai Peninsula. Whether you take the three-hour drive out Mystery Creek Road, use four-wheelers along the beach from Captain Cook, or fly in with a friend, the Chickaloon flats can provide some excellent early and late season shooting. Mystery Creek Road is a long 36 miles, following the Enstar gas pipeline to Turnagain Arm. At best the road is marginally drivable; a four-wheel drive with good tires is a must, and a shovel, come-along, jack, cell phone, and overnight gear are highly recommended. If you have a four-wheeler, the best option is to start from Captain Cook State Recreation Area at low tide, follow the beach to the Refuge boundary, and hike from there. Hunters are reminded that the Refuge is closed to off-the-road vehicles; if not licensed through the State DMV, it's not allowed on the Refuge. Aircraft are a final option for reaching the Chickaloon flats. There are three landing strips on the flats, which are described in our aircraft brochure available at Refuge Headquarters.

Once you have made it to the Chickaloon flats, what kind of hunting can be expected? Both pass shooting and decoys can be successful on the flats. Decoy hunters typically set up on little ponds and sloughs near the Chickaloon River. Pass shooters tend to walk out onto the flats and hunt with the tide change. If you decide to try your hand at pass shooting, remember that the flats can be very tricky to navigate, and always keep your eye on the incoming tide. I speak from personal experience of having to swim across a slough that had been dry when I crossed it not 15 minutes earlier. During the fall hunting season all types of ducks use the flats, along with Canada geese, sandhill cranes, and occasional snow geese.

If your are looking for a spot somewhat easier to access but with limited hunting pressure, then try heading across Tustumena Lake to the glacier flats. These flats are located on the east side of Tustumena Lake, about an hour boat ride from the Kasilof River boat launch. The hunting on the flats can be excellent because hunters further south are pushing the birds out of the Fox River drainage. You can expect to find a variety of dabblers as well as divers using the flats. Most hunters that I have talked with in this area prefer to jump hunt rather than setting up decoys.

Folks hunting the Tustumena flats, as always, should be mindful of the presence of brown bears. Glacier Creek on the northern edge of the flats is home to a fairly large salmon run in the fall, as well as a good concentration of brown bears fattening up for the winter. As with all glacial lakes, the wind on Tustumena Lake can be fierce and unpredictable, so pack your survival gear and be prepared to spend an extra day if need be.

Two good spots for hunters that don't want to spend time boating across Tustumena Lake are the inlet and outlet of the Kenai River at Skilak Lake. You can reach the inlet by boating eastward around the corner from Upper Skilak Campground; the outlet is best reached by boating westward from Lower Skilak Campground. In either case you'll find a good variety of ducks. Waterfowl hunters are reminded that hunting is restricted to the south shore of the Kenai River.

Hunters who use the Kenai River below Skilak Lake will typically have a little better luck because fishermen moving up and down the river tend to keep the birds moving even on the calmest of days. Hunting both above and below Skilak Lake is best done with decoys placed in marshy areas. Many diving ducks use these areas, but mallards, teal, and widgeon will also fill the bag, if a hunter has patience.

Now that we know some of the places with good hunting, let's quickly review the basic regulations that govern waterfowl hunting. Bag/possession limits are as follows for the entire Peninsula: ducks eight per

day, 24 in possession; sea ducks, 10 per day, 20 in possession; dark geese four per day, eight in possession; white geese three per day, six in possession; snipe eight per day, 16 in possession; and sandhill cranes two per day, four in possession. Lead shot may not be used or possessed while waterfowl hunting, so be sure to clean out your jacket from the grouse hunt. Successful hunters must leave a fully feathered wing or head attached to the bird for species identification. Shotguns must be capable of holding no more than three shells total. Motor boats cannot have their motor running; all forward progress must be stopped prior to shooting from a boat. Birds cannot be intentionally harassed for the benefit of the hunter. Finally, baiting is not allowed at any time for migratory birds. Additional regulations can be found in a pamphlet available at Refuge Headquarters, Alaska Department of Fish and Game Headquarters, and at local sporting goods stores.

Rob Barto is a law enforcement officer on the Kenai National Wildlife Refuge. Previous Refuge Notebook columns can be viewed on the Web at http://kenai.fws.gov.

The Alaska Guides took trophy hunters to Tustumena Lake in 1920-30's

by Gary Titus

Many people have lived on the Kenai Peninsula for years and have never seen one of its most striking features—Tustumena Lake. This huge lake (25 miles long and five miles wide) is almost as big as Kachemak Bay, but it is off the road system and is usually accessed by boat from the Kasilof River. Historical log cabins are found occasionally along on the shores of Tustumena Lake, and the moose, bear, sheep and other game that roam the hills have long attracted the interest of outdoorsmen. Herein lies the story of one such outdoorsman Gus Gelles and his trophy hunt guide business—the Alaska Guides, Inc.

In the fall of 1925 Gelles, a salesman and entrepreneur from Anchorage, flew with pioneer aviator Russell Merrill over the Kenai Peninsula, checking out good hunting and fishing areas. Gelles had the idea of organizing the peninsula's hunting guides into one organization. In 1926 he formed the Alaska Glacier Tours Association (AGTA), with headquarters in Anchorage, and a base camp called "Birchwood" on the northeast shore of Tustumena Lake near the mouth of Bear Creek (formerly known as Birch Creek). In 1927 Gelles changed the Association's name to the Alaska Guides, Inc., by which name the group is usually remembered today.

On August 13, 1926 the Association's first group of hunters arrived from Seattle. They made the trip from Anchorage to Kasilof on the Association's new boat AGTA, and continued up the Kasilof River by powerboat. The party was guided by Alex Liska, Fred Judd and Andrew Berg. After spending a month hunting in the Tustumena Lake area and taking many motion pictures of game, the hunters returned to Anchorage enthusiastic over the experiences they had enjoyed on their trip.

The hunting camps of the Alaska Guides were of the highest standards; at the Birchwood base camp, wall tents were equipped with chairs, dressing tables, rugs, spring beds, mattresses, sheets and pillow cases. Fires were laid each morning and evening. The hunters traveled from the base camp by horseback to moose camps and sheep camps. Packers were sent ahead to set up the camps with all the comforts, including a cook.

A sure sign of a good hunting camp is the quality of the food. For example, consider this dinner menu served at the Alaska Guides' base camp by chef Andy Leland: cream of oyster soup, cold slaw, sweet and sour pickles, brook trout, tenderloin of moose a la hamburg with onion dressing, served with wild cranberry sauce; boiled ham and cabbage, sweet potatoes, white potatoes, creamed peas, mushrooms fried in butter, Tustumena frijoles, white and raisin bread, hot baking powder biscuits, strawberries, coconut banana layer cake, sugar cookies, doughnuts, molasses drop cakes, creamed Swiss cheese, tea and coffee.

A typical hunt would cost about $1324, which included round trip from Seattle to Seward via steamer, round trip from Seward to Anchorage via railroad, and roundtrip by plane or boat to Tustumena Lake, complete with guides, food and lodging.

Well-known personalities hunted with the Alaska Guides: Coloman Jonas, the president of the Denver taxidermy firm Jonas Brothers; Captain Billy Fawcett, publisher of "Whiz Bang" magazine; and Van Campen Heilner, field representative of the American Museum of Natural History and associate editor of "Field and Stream" magazine, to name a few.

In 1930 the Alaska Guides was the largest organization of its kind in the world; they employed 45 men and had brought in $250,000 dollars over the previous five-year period. They had $25,000 invested in sixty head of horses, saddles and camp equipment.

The Alaska Guides operated in the Tustumena Lake region into the late 1930's, when the company was finally disbanded due to financial difficulties. Today all that remains of the Birchwood camp are a few logs and faded photographs of happy outdoorsmen.

Tustumena Lake still attracts hunters from all over the world for moose, caribou, Dall sheep and bears. Hikers and horsemen continue to explore the vast wilderness. Fishermen test their skills with the wide variety of fish, and all users enjoy the untrammeled beauty of Tustumena Lake, which many would con-

sider the "Crown Jewel" of the Kenai National Wildlife Refuge.

Gary Titus is the Wilderness Ranger and Historian at the Kenai National Wildlife Refuge. Previous Refuge Notebook columns can be viewed on the Web at http://kenai.fws.gov.

From the Refuge to "The Abyss"

by Dianne MacLean

People come to Alaska for a variety of reasons. For some it's definitely a fling: the great fishing, abundant wildlife, every day a Kodak moment, then returning home to the security of routines and the conveniences of modern lifestyles. But for some, Alaska is true love, and it is not enough to be a spectator. There are many people like that on the Peninsula, and many who work on the Refuge. They live within the seasons, cycles, and challenges that are unique to life here, often exposed to unforgiving circumstances where routine decisions affect the well-being of everyone involved. The setting is beyond your average great place to be; the logistics are more complicated, the weather is more unpredictable, help is much further away. Alaska provides the yardstick of "bigness" against which other places are measured.

During the past fire season I was sent from the Kenai Refuge to a fire on the North Rim of the Grand Canyon. I thought that would be…'nice.' But compared to the grandness of the Chugach range, or Prince William Sound, or the Kenai Peninsula, just how "grand" could the Grand Canyon be?

My assignment was to manage the helicopter base, where I would address the needs of the aircraft and their crews, and respond to the priorities of the fire. In short, my job was to make things run better, rather than worse, regarding helicopter efficiency and safety. The Grand Canyon National Park has facilities on both the north rim of the canyon and the south rim. Flying between the south rim and north rim is known as "crossing the abyss."

Visitors to the rims can use picnic tables along the paved drives, or enjoy the massive stone and timber lodge, shops and restaurants. Step away from those conveniences and the visitor, or the firefighter, is engulfed in a hostile environment the scale of which I had not seen anywhere outside of Alaska. Outings rapidly escalate into life-or-death situations when people come ill-prepared, still accustomed to security and convenience. Even those of us whose jobs demand preparedness found sudden shock in any lapse: failure to carry enough water, to allow enough time, to anticipate the worst.

Late one afternoon, a call for help came in to our helibase. A rafting accident had just put 15 people into the Colorado River, and the Park needed a helicopter from the fire to help pull them out of the canyon, before it got too dark. As we flew from the North Rim, our pilot radioed that we were "crossing the abyss." Our ship might as well have been a mosquito transported to Mars. The scene was otherworldly—beautiful and vast on the scale of the Chugach Mountains turned upside down. Trying to take a photograph seemed pointless. A twisted car body lay nestled among rocky teeth several hundred feet below the south rim, where a despondent individual had driven off a month before.

The helicopter threaded downward through the narrow canyon walls. On the ground, the turning rotors generated a wind of superheated canyon air that was painful to breath, and we rescuers were made aware of our own vulnerability: the immediate need to drink, to have brought enough gear, to not lose communications with the rest of the world. The rescue proceeded in that tense, forced calm so necessary in emergency response. It brought a sense of accomplishment as a team, of appreciation for one another's abilities. As our pilot called in that we had just crossed back over the abyss and were returning to the helibase, I thought about Alaska and the Grand Canyon and of their similar, beautiful harshness. Without this harshness, many things would be easier, but there would be no test, less of a challenge to meet, and perhaps less of life to appreciate.

Dianne MacLean is a career firefighter, working in both prescribed fire and fire suppression. She came to the Kenai Refuge last year from the Forest Service, after working several summers on the Chugach National Forest, which followed twelve years of service on the Okanogen National Forest in Washington. Previous Refuge Notebook columns can be viewed on the Web at http://kenai.fws.gov.

Ecological changes obvious on the Kenai Peninsula

by Ted Bailey

Many significant ecological changes are occurring on the Kenai Peninsula. Some have occurred so slowly or are so subtle that they escape notice of the casual observer confined to viewing the landscape from the ground. Those who have lived on the Kenai more than 20 years and have spent a lot of time flying over the Peninsula can readily relate to some of these changes because of their advantageous "bird's-eye" aerial view. Having met both of these criteria, I would like to share a few of the changes I have noticed since the 1970's. Most of the changes have become much more visible during the 1990's.

Some of the most obvious changes are the retreating glaciers and the shrinking Harding Icefield. These changes are most conspicuous to me because I can readily remember the different locations of the ice edges and adjacent rock or water. For example, in the late 1970's, the fronts of the two major glaciers—Skilak and Tustumena—were much farther down their valleys than they are today. An 1898 photograph of big-game hunter Dall DeWeese with the Tustumena Glacier in the background shows the front of the glacier well to the west of a prominent rocky point on the north side of the valley. No large lake can be seen at the glacier face. Aerial photographs taken 52 years (in 1950) and 78 years later (in 1976) show the face of Tustumena glacier still lying roughly one-half mile west of this point, but with a lake developing at the glacier face. That is where I remember seeing the Tustumena glacier on one of my first wildlife survey flights over the area in the late 1970's.

However, after a relatively brief period of twenty years, the face of Tustumena Glacier today has retreated well eastward of the rocky point, and a large glacial lake lies between the face and a prominent moraine formed about 1864. Detailed studies of glacial retreat on the Kenai Peninsula by Gregory Wiles from the Lamont-Doherty Earth Observatory at Columbia University confirm the retreat of Tustumena Glacier. According to Wiles, who dated the moraines with tree-rings and lichen diameters, the glacier started backing up at the end of the Little Ice Age in the mid-1850's, and its retreat appears to have been accelerated by the formation of the lake at its face.

Simultaneous with the pullback of Tustumena Glacier has been the periodic draining of a nearby meltwater lake. At least twice in the past five years, the large Arctic Lake has completely drained out underneath Tustumena Glacier, causing noticeable water level rises in Tustumena Lake and its outflowing Kasilof River.

The retreat of Skilak Glacier has been even more pronounced, especially during the last ten years. Skilak Glacier has now retreated well over one-half mile up valley, and a large glacial lake lies between the face of the glacier and its 1970's location.

Edges of the Harding Icefield have also retreated, exposing more rock and mountain slopes. This melting of ice was quantified in a recent study by Gudfinna Adalgeirsdottir from the University of Alaska-Fairbanks. Using aerial photographs she estimated the total volume of ice of the Harding Icefield has shrunk by about 8 cubic miles over a 43-year period; this translates into a loss of about 70 feet of icefield thickness since 1950. I found especially interesting her observation that the ice thickness on Skilak Glacier shrunk 10 feet between 1994 and 1996; this agrees with my "eyeball" observations that the rate of melting has accelerated over the last decade.

Significant changes have also occurred in the refuge lowlands over the past 20-30 years. Vast areas of spruce forest from Point Possession at the northern tip of the Peninsula to the Fox River Valley in the southern region of the refuge have been heavily thinned by the spruce bark beetle. In forested areas once dominated by mature white spruce trees, the canopy is now more open and the understory vegetation is changing.

Furthermore, the levels of numerous closed-basin lakes have dropped and many exposed lake shorelines are evident. The most evident shrinking lakes are in the Mystery Creek area and include Picnic, Browse, and Campsite Lakes, as well as nearby Dogteam and Upper Jean Lakes. In other shrinking lakes, new peninsulas and islands are appearing as lake levels drop. On a smaller scale, numerous small ponds once used by breeding wood frogs have dried up completely; other ponds have found their margins shrink-

ing up to 100 feet from early 1990's shorelines.

All of these ecological changes and studies support the fact that the climate is warming, especially in recent decades, and that this warming is having an impact on the refuge and the rest of the Kenai Peninsula.

What do all these changes mean for fish and wildlife? The bottom line is that we often don't know, because of the complexity of ecosystems and our lack of knowledge of how northern landscapes will continue to respond to climatic warming. However, some earlier predictions have already come true. One was the prediction that a warming climate could trigger substantial insect outbreaks in the northern boreal forest. The present round of spruce bark beetle outbreaks on the central and northern Kenai Peninsula began in the early 1970's. Analysis of past Kenai Peninsula weather data by ecologist Ed Berg on the refuge staff has revealed warming temperatures with greater evaporation and water loss by plants (transpiration), beginning with the drought of 1968-69. This has meant about 35% less water available for plant growth, stream discharge and groundwater recharge. Less available water has meant more drought-stressed trees and spruce bark beetle infestation, as well as falling lake levels and dried up ponds.

Loss of mature white spruce forest could affect populations of spruce grouse, red squirrels, and neotropical migrant birds, such as Townsend warblers, which breed on the refuge. In our annual spring breeding bird surveys we have not in the past seven years recorded any of these specialized warblers, which favor mature white spruce forest. Declining water levels could influence numbers of breeding shorebirds, waterfowl and waterbirds on the Peninsula. Fewer favored places are available for breeding wood frogs and other species that rely on small ponds for survival.

What does the future hold for us and the many forms of life that share the Kenai Peninsula? We are entering an era never before witnessed by modern humans. At best, we will continue to document the changes, but only after they have already occurred and those changes that are most obvious. Sometimes we'll attempt to predict some outcomes, and maybe we'll be right or wrong. Many of these changes will eventually affect our lives and those of our children. We will have to adapt and perhaps change our lifestyles. Water tables, trees and other vegetation, and fish and wildlife distribution and populations will likely continue to change. More subtle changes may completely escape our notice until they are later pointed out by future researchers. Some of the researchers' predictions have already come true on a local as well as a global scale. But regardless of the confirmation, accuracy or timing of the predictions, significant changes are occurring and we are all along for the ride.

Ted Bailey is a supervisory wildlife biologist and has been responsible for the Kenai National Wildlife Refuge's biological programs for over 20 years. He and his staff monitor and conduct studies of ecological conditions and wildlife on the refuge. Previous Refuge Notebook columns can be viewed on the Web at http://kenai.fws.gov.

Snowmachine season is almost here

by Bruce Bigelow

Snowmobiling is a popular winter recreation activity enjoyed by millions of people across North America and especially on the Kenai Peninsula. It can also be a dangerous activity and each year hundreds of people are seriously injured and killed while snowmobiling. The main causes of snowmobile accidents are alcohol and excessive speed. To enjoy the sport of snowmobiling safely, each rider needs to accept responsibility for his or her own safety and survival.

Safety Tips

- Always wear a safety-certified helmet: Your helmet needs to be snug fitting and should include a face shield or goggles. The helmet provides protection from the cold and wind as well as from impact.

- Dress appropriately: Dress in layers so you can add or remove a layer to match changing conditions and activity level. Start with a layer of synthetic or wool long underwear; cotton looses its insulating properties when it gets wet and should be avoided. Add layers of wool, synthetic fleece or other heat retentive fabrics depending on the temperatures. The outside layer needs to be windproof because the windchill added by even slow travel on a snowmobile is significant. Avoid tight fitting boots and gloves that may restrict circulation.

- Don't drink and ride: Alcohol impairs judgment and increases the risk of hypothermia, a cooling of the body's temperature that can be fatal. ALCOHOL DOES NOT WARM A CHILLED PERSON. Instead it opens the body's blood vessels and removes the feeling of chill leaving the person more susceptible to the cold. DUI on a snowmobile is the same charge as DUI in a car; you will LOOSE YOUR DRIVERS LICENSE if you are caught riding under the influence.

- Keep your eyes open and the speed reasonable: Kenai Peninsula trails are used by skiers and dog mushers, as well as by other snowmachiners. Don't go into a limited visibility situation at a high speed—there may be somebody on the trail just over the hill or around the bend.

- Keep your machine in good working order: Have it checked over and serviced before the riding season. Follow the pre-ride checklist in your owner's manual. A 5-minute check at home or at the trailhead can help you avoid being stranded by a breakdown in the field. Always carry a tool kit with a spare drive belt, towrope, spark plugs

- Don't ride alone: Always ride with a friend and stay together in the field.

- Leave a trip plan: Let a responsible person know where you are going and when you expect to be back.

- Bring snowshoes: Strap them on the back of your machine; if you break down they may be your only way out.

- Stay physically fit: Riding a machine, especially in deep snow is a rigorous workout. Don't ride with anyone who couldn't make it back in the event of breakdown.

- Bring a winter survival kit: First aid kit, matches and fire starter (railroad flares work great, are water resistant and can double as a signal), map and compass, flashlight with extra batteries, sleeping bag, high calorie food, metal container to melt snow. A cell phone is a great addition to the survival kit but you still need to bring the basics (cell phones don't keep you very warm and are hard to eat). An extra cell phone battery can prove very useful, especially if warmed in an armpit.

- Carry avalanche gear in the mountains: Shovel, probe and avalanche transceiver. You need all three items together; one is not much help without the other. It is best to carry your avalanche gear on your person (in a backpack) instead of strapped to your machine. If you are involved

in an avalanche and manage to get out your machine will most likely be buried and it's hard to help find your friends without your gear.

- Educate yourself: Take an avalanche awareness course. For more information contact the Alaska Mountain Safety Center, 9140 Brewster's Dr, Anchorage (907-345-3566).

There is a free Avalanche Hazard Recognition Workshop on Saturday December 2nd at the Soldotna High School Auditorium from 9:00am to 5:30pm, sponsored by Kenai Peninsula Office of Emergency Management. Pre-registration is requested. Contact Kay Steele or Bonnie Hanson at the Kenai Peninsula Borough Office of Emergency Management: 262-4910 or toll free 800-478-4441.

The Kenai National Wildlife Refuge is presently closed to snowmobiles until sufficient snow depth accumulates to protect underlying vegetation and terrain. There are certain areas of the Refuge that are never open to snowmobiles. These include all areas above tree line, except the Caribou Hills, and all maintained roads in the Refuge. Within the Skilak Loop Special Management Area, snowmobiles are prohibited except on Hidden, Kelly, Peterson and Engineer Lakes for ice fishing access only. The Swanson River Canoe Route and The Swan Lake Canoe Route and portages are closed to snowmobiles. If you plan on riding on the Refuge this winter, stop by the Refuge Office on Ski Hill road for a snowmobile map. It is the riders' responsibility to know where they can and cannot ride. The map is free, but the fine for snowmobiling in a closed area is $100. Ride smart and ride safe, and we'll see you out on the trails!

Bruce Bigelow is a law enforcement officer at the Kenai National Wildlife Refuge. Previous Refuge Notebooks can be viewed on the web at http://www.fws.gov/refuge/kenai/.

Cutting that special Christmas tree

by Candace Ward

Each year Kenai National Wildlife Refuge opens refuge lands to individual household Christmas tree cutting from Thanksgiving to Christmas. Many local folks enjoy their annual holiday outing to find the perfect tree and consider the "tree hunt" to be one of their favorite holiday traditions. Others get into a hurried rush over finding their tree and find the experience a pressured ordeal. After fifteen years of answering visitor questions on the "how-to" of finding the perfect tree, here are a few insights to make the experience for your family smoother, more fun, and kinder to the natural world.

First plan on making the outing fun for the whole family. With the driving time from the central peninsula to a refuge location and time on the ground to find your tree, you will spend an average of four hours. So, bring snacks, juice, and a few well-chosen audio tapes for the car trip. Bring layered clothing to stay comfortable and warm inside and outside the car. Bring a few pillows to let the kids and your spouse nap on the trip home.

Tools for cutting the tree need to be prepared before loading the family into the car. A sharp ax or hand saw is a must. Rope to tie the tree securely to the vehicle for the trip back is also essential. A measuring tape is a great addition to the tool kit especially if you measure the area in the house you plan to put the tree in ahead of time. That way when you are ready to cut, you can double check the tree for size before you cut it. Depending on snow conditions be sure to take snowshoes and a sled if you are going out in deep snow. If icy, give us a call at the refuge visitor center so we can update you about hazardous road conditions.

Take only one tree per household. Cut in the right place. On refuge lands to cut a Christmas tree you must be 150 ft. from any road, trail, access area, or water body (lake, stream, river, pond, etc.). The reason for this requirement is to spread out the impact of taking trees. Cut the tree as near to the ground as possible. This measure reduces the safety hazard of sharp stumps sticking out of the ground.

A few other tips for tree cutting include walking around the tree and making sure it is the right shape. Often the tree doesn't have to be perfectly symmetrical since one side usually faces a wall. If it's snowy, shake the tree so you see the true shape. Remember once you cut the tree it's yours. Discarding a tree to cut a "better" one is a "sure fire" way to get a ticket and you don't want your family outing to end in costly frustration.

Know where it's legal to take a tree in the refuge. The area around refuge headquarters in Soldotna is closed to taking of Christmas trees. The next closest refuge area to Soldotna for tree cutting is out Funny River Rd. Go past the airport and note the refuge entrance sign. The refuge borders the south side of Funny River Rd. for six miles and a tree can be cut in this area.

Traveling north from Sterling on Swanson River Rd., look for the refuge entrance sign just before Mosquito Lake. From this sign you are now in the refuge for the rest of Swanson River Rd. and also for Swan Lake Rd. Refuge oil field roads in this area are closed to vehicles, but you may enter on foot to cut a tree. Traveling east from Sterling look for the refuge entrance sign. The Sterling Highway corridor inside the refuge from this point to Russian River and Skilak Lake Rd. are legal areas to cut your tree. Remember that 150 ft. distance. That equals 50-70 adult walking strides.

Each year I ponder the cumulative impact of cutting thousands of young trees on the refuge. In Alaska with our short growing season many of the four to six ft. evergreen trees can be 20 to 50 years old depending on the species and the location. So even though it is perfectly legal to take a Christmas tree if you follow the previous guidelines, take a moment to think about ways to reduce your impact. Are you in an area where young trees are crowded? Thinning out a crowded tree can be beneficial to the entire stand. Is a tree injured or uprooted? Choosing an injured tree that won't make it over the long term will reduce the long term impact of Christmas tree cutting.

Christmas is a season where we celebrate our religious, cultural, and family heritages. We examine our relationships with family and friends and find ways to show our appreciation for them. When we reach out to others in the spirit of generosity, let's not forget

the natural world too. We depend on it for air, water, food, shelter, necessities, and recreation. Not only can we minimize impacts on the natural world in selecting and cutting a Christmas tree, but we can also give nature a gift by acting in ways that care for and protect our living planet year round.

For more information on Christmas tree cutting and other refuge topics, call 262-7021 or visit the refuge web site at http://kenai.fws.gov.

Candace Ward has been a Park Ranger at Kenai National Wildlife Refuge for over 15 years. She coordinates the refuge's information and education programs. Previous Refuge Notebook columns can be viewed on the Web at http://kenai.fws.gov.

Firewood gathering on the Kenai Peninsula is not as easy as it seems

by Doug Newbould

You might think that with the millions of dead spruce trees on the Kenai Peninsula, getting a load of firewood should be a simple task. At almost any point on the road system where you can see mature stands of white spruce, you can bet that some of the trees are dead—victims of the spruce bark beetle. So, with a seemingly endless supply of dead firewood, why is it so hard to get a few cords laid up each year for those cold winter months?

In a word, the answer is—access. Whether it's a firewood permit for a special wood-cutting area on public lands, written permission to cut and remove wood from a private landowner, or enough snow on the ground for you to take your snowmachine out to that dead snag you've been eye-balling for the past six months…access is the key to successful firewood gathering. And I'm talking about legal access here. We all need to understand that every tree in the United States of America (including Alaska) is somebody's property. You own the trees on your land, your neighbor owns his/her trees, and we all own the trees on public lands—collectively.

If there were a wood-cutter's bible, the first commandment would be: "thou shalt not covet the trees on thy neighbors' lands." The second commandment should be: "thou shalt have written permission to remove any tree or wood product from any lands other than thine own." (Note: the *Refuge Notebook* editor has complained that I tend to get a little bit preachy in my columns, and I guess this proves him right.)

Ok, so how does one go about getting access to some firewood? Well it helps if you are resourceful, tenacious and hard-working. Or, you need enough money to pay someone else to be resourceful, tenacious and hard-working. The easy way is to pay for someone to deliver firewood to your house. You can expect to pay from $50 to $200 per cord of wood—depending on the species and quality of the wood; whether the wood is delivered in log or firewood lengths; if it's cut in rounds or split; and whether it's unloaded in a pile or stacked neatly. A cord is 128 cubic feet or a 4' x 4' x 8' stack of wood: that's a full-sized pickup truck bed with side racks loaded to the top of the cab.

If you don't want to pay someone else to get your firewood or you're one of those strange people (like me) who enjoy the whole process of firewood gathering (except for the sore back of course), here are some ideas about where to go:

Kenai National Wildlife Refuge [262-7021] - Personal use firewood permits can be purchased at Refuge Headquarters on Ski Hill Road in Soldotna. Permits are $20 (non-refundable) and limited to five cords per permit, per household. Maps of the permit area off Funny River Road are provided with each permit.

Alaska State Forestry [262-4124] - The State does not have a designated area for wood-cutting, but you can cut personal use firewood on non-designated State land (not in parks, habitat areas, etc.). Dead-standing trees or dead and down wood can be cut and removed from these non-designated State lands, free of charge and without a permit. The Division of Forestry office in Soldotna has land status maps to assist you in locating areas that are State-owned and legally accessible.

Chugach National Forest / Seward Ranger District [224-3374] - Dead standing or dead and down trees may be cut and removed from the Chugach National Forest without a permit, for personal use only. Areas that are closed to the removal of wood products include campgrounds, trailheads and active timber sales. Motorized vehicles may not be taken off forest roads and highways without a permit. Contact the Seward Ranger District for more information.

Private lands - Search the local bulletin boards and the classifieds for private landowners who are selling firewood. Some are giving it away if you will fall the trees and pile the slash. A more ambitious plan would be to team-up with your neighbors and complete a FireWise Community Action Plan. Your neighborhood "team" could contact owners of vacant lots, organize work crews to cut trees and dispose of slash, or contract with a logger to cut and remove dead and

infested trees (leaving useable firewood for property owners). Some local neighborhoods have been very successful using the FireWise process. Your local fire chief, the fire managers at State Forestry and I are all willing to help you get started with a FireWise project in your neighborhood. Developing a source of firewood in your area can be an important part of the project, as well as the fire prevention aspect.

In almost ten years of public service here on the Kenai, I have worked with many people who were having trouble finding firewood to heat their homes. I know it isn't easy. But it is possible to access a supply of firewood with a little ingenuity, tenacity and effort. And please remember to be safe out there in the woods. Use proper techniques and personal protective equipment during your wood-cutting activities so you can enjoy many toasty fires this winter.

Doug Newbould is the Fire Management Officer at the Kenai National Wildlife Refuge. For more information about firewood gathering on the Refuge, visit our headquarters on Ski Hill Road in Soldotna or call (907) 262-7021. Previous Refuge Notebook columns can be viewed on the Web at http://kenai.fws.gov.

The wily coyote

by Elizabeth Jozwiak

The box says Acme Explosives: the target is that pesky roadrunner that zips through the desert canyons with one goal in life to tantalize Wile E. Coyote. In cartoons the coyote is always the victim of his own schemes; he gets bulldozed, blown up, and otherwise clobbered in every episode. In real life however, the tables are turned; it is the coyote that has the brains, the cunning, and the determination to survive.

Coyotes are actually doing quite well across North America. While most other larger carnivores such as the brown bear, wolf, and lynx have declined because of human encroachment and habitat loss, the coyote has adapted to living in the urban and suburban environment.

Prior to the arrival of European settlers, coyotes were found in the central part of the U.S. and in northern Mexico. Today their range extends from Panama to Alaska, including all of the continental U.S. states. The elimination of wolves from much of their historic range in North America has allowed the coyote to move in and increase its population and range with little competition from anyone.

In Alaska coyotes were first noted in the early 1900's. Populations were reported on the mainland of Southeast Alaska, and then slowly expanded northward into the upper Tanana Valley from which they radiated out in all directions. There are fewer coyotes north of the Yukon River. Coyotes probably expanded to the Kenai Peninsula when wolf numbers were extremely low due to predator control efforts in the 1920's -1950's. Coyotes filled the niche the wolf left, and may have reduced or eliminated the Peninsula's red fox population through competition.

However, all that changed when wolves returned and naturally recolonized the Kenai Peninsula in the 1960's. Coyotes continue to exist, but now they share the Peninsula with another (and larger) canid species, which does not tolerate them very well. In most cases, wolves are fiercely protective of their territories, and will kill any coyote they encounter.

Kenai Refuge studies of this rather unique coexistence of wolves and coyotes suggest that there is little direct competition for food resources. From scat analysis we have found coyotes to rely primarily on snowshoe hares, porcupines, small mammals, and road kills, while wolves preferred moose. Coyotes have also learned to avoid wolf packs because a confrontation usually results in the coyote's death. However, on one occasion several winters ago, as I watched a wolf pack feed on a moose kill, I observed a wary coyote come out of the trees and sneak quick bites of the moose carcass after the wolves retreated into the woods to rest. Studies in Minnesota and Michigan have documented coyotes living on the periphery of wolf packs and scavenging off their kills after the pack leaves the area.

Coyotes living close to human populations are usually safe from wolf encounters. Being true generalists, coyotes can change their diet from natural wild prey to accommodate whatever is available in an urban setting. Most of the time, coyotes go out of their way to avoid humans, but they are discovering that humans are a good source for food. This behavior can sometimes lead to conflicts with humans that own livestock and domestic pets.

Coyotes are opportunistic; they will kill and eat small dogs and house cats, and will even make a meal out of pet food or table scraps that are left outside. If certain precautions are followed, these kinds of encounters with coyotes can be minimized. Not allowing your domestic pets to roam freely and securing your livestock will probably keep a coyote from eyeing your turkey, cat, poodle, or rabbit as its next meal. Keeping your trash containers closed, and pet food in the house or barn will make these resources unavailable to coyotes.

The coyote, being one of the Kenai Peninsula's newest residents, has found its niche on the Peninsula, both within the wilderness of the Kenai Refuge as well as in our backyards. The next time you hear the coyote's high-pitched yips, barks, and howls, think about how this clever coyote has learned to "roll with the punches" and "go with the flow." If only we humans could be so adaptable!

Elizabeth Jozwiak is a wildlife biologist for the Kenai NWR. She studies a variety of Alaskan birds and mammals, but her current interest focuses on wolves. Previous Refuge Notebook columns can be viewed on the Web at http://kenai.fws.gov.

Dating historic cabins and archeological sites with tree-rings

by Ed Berg

We've had lots of fun moving the old Andrew Berg homestead cabin up to the Refuge Headquarters. Our Youth Conservation Corps teenagers brought the logs up from Tustumena Lake last summer, and Refuge Historian Gary Titus mobilized many community volunteers for the cabin raising party in September. The new spruce shake roof is on, and the cabin is closed in for the winter.

Readers of this column may recall my articles about using tree-rings to date old wood. There are many old cabins on the Refuge; some are no more than a relict corner of logs protected by an overhanging spruce, others still have upright walls, and some are still in use today. Many of these structures can be dated with tree-rings because they were made with locally-grown trees.

Gary Titus wasn't quite convinced that such dating was possible, so I said we should put the idea to a test. We know from Andrew Berg's diary that he started putting up the logs for his cabin on April 21, 1935. If we were to date a log from this cabin, it shouldn't date any later than 1935.

To start the dating process, Gary sawed off a disc from a discarded log and sanded it well with a belt sander using 400-grit paper. I then took a sharp needle and scored five radii on the sanded face. The next step was to measure the width of the tree-rings year by year along each radius. This would give us five independent sets of ring-width measurements. We measured the ring-widths in our lab with a remarkable device called a "sliding bench micrometer," which is connected to a 60x microscope and a computer. With this machine we can easily measure ring-widths to 0.01 millimeter. We recorded each measurement on the computer by pressing a button. It took about 20 minutes to measure the 88 rings (years) of a single radius.

Next came the magic, called "cross-dating." With cross-dating, the measured (but undated) ring-widths of the sample are statistically compared with a reference series of dated ring-widths called a "chronology." Once the sample is properly lined up with the chronology, the age of each ring of the sample becomes known. The year of the outermost ring is the "death date" of the sample.

We used a chronology averaged from 91 trees in the Tustumena Lake area. Over the last several years Andy DeVolder and I have developed this chronology, starting with 48 live white spruce (with known outer ring dates), and subsequently adding many dead trees from the 19th century. The dead trees were cross-dated against the live trees, and then added to the chronology to extend it back in time. The chronology now covers the period 1601 to 1996.

In order to effectively cross-date dead wood, there must be some year-to-year variation in ring-widths, because cross-dating is based on the idea of matching up relative ring-widths between the unknown sample and the known chronology. The "fat" rings of the sample are matched with the fat rings of the chronology, and the "thin" rings are matched with the thin rings. If all the rings are the same width, this can't be done; one match is as good as another, and hence useless.

The disc from the Andrew Berg cabin was not especially promising; many of the rings were about the same size. This condition is described as "complacent" and it indicates a benign site with favorable growing conditions. For effective cross-dating we like a "stressed" tree, where the tree is sensitive to differences in growing season temperatures or precipitation, and there is much variation in ring-width from year to year. Furthermore, this tree was rather young, with only 88 rings.

Nevertheless, all five radii from the sample dated quite convincingly to 1934, with correlations ranging from c = 0.37 to 0.71 and a mean of c = 0.49, between the individual radii and the white spruce chronology. (A correlation of c = 1.00 is the highest possible score—a perfect correlation.) This is a remarkably good result, especially given a complacent sample, with only a moderate number of rings.

To further test the robustness of the methodology we cross-dated the five radii with a black spruce chronology, using 15 trees from the Windy Point burn area, covering the period 1769 to 1993. The log from

the Andrew Berg cabin is most likely white spruce, given its large diameter (8") for an 88-year-old tree. The black spruce chronology correlated rather poorly with the white spruce chronology (at c = 0.33), indicating that white and black spruce respond somewhat differently to climate in this area. This is not unusual, and normally we try to avoid mixing species when cross-dating. Nevertheless, four of the five radii cross-dated to 1934, which is surprisingly good. The fifth radius dated to 1910, which is clearly a spurious correlation.

Cross-dating shows the death date of the tree, not when the building was constructed. A cabin could be built several years after the tree was killed, but not before that time. As noted, Andrew Berg's diary tells us that he began building this cabin in 1935. One might expect, however, that he cut many of the trees the year before in order to let them cure over the winter, so 1934 is an entirely acceptable death date for this log.

The dark part of a tree-ring is called the "latewood" and it typically forms in late July and August in this area. The late wood of our sample was just beginning to form and was not complete, indicating that the tree was probably cut in late July of 1934.

We would like to use this method to date older wood, say from archeological sites. Our present chronology could be extended back from 1601 by another 500 or 1000 years by adding more dead (and probably buried) wood. This would cover many of the Dena'ina house pit sites in the Soldotna–Kasilof area.

In western Prince William Sound, grad student David Barclay collected dead trees exposed by recent retreat of various glaciers. Using cross-dating, he developed a chronology back to 873 A.D. That chronology could be used to date archeological wood between Seward and Whittier, but it probably wouldn't work on this side of the mountains because the climate is so different.

Generally, if wood has been kept underwater or below the water table in the ground, it can remain sound for hundreds of years. Foundation excavations, drained lakes and wetlands, gravel pits, river bank erosion faces—any of these could turn up long-buried wood that is still pretty solid with useable rings.

So, let me put out a call to all home builders, excavators, and backhoe operators: if you dig up any solid logs, please give us a call at 260-2812 or 262-7021 so that we can get a sample (e.g., a disk). Your old logs might be the keys to unlocking some exciting archeological history of our Native predecessors.

Ed Berg has been the ecologist at the Kenai National Wildlife Refuge since 1993. Previous Refuge Notebook columns can be viewed on the Web at http://kenai.fws.gov.

What will the new year bring?

by Robin West

Have we just finished the first year of the new millennium or are we just entering it? I don't know, but I do know that we are entering another new year along with its opportunities and uncertainties. Dusting off the crystal ball, I'll look ahead to predict a few things that the new year may bring to the Kenai National Wildlife Refuge.

The year 2001 brings the 60th anniversary of the Kenai Refuge. It's hard for me to imagine that President Roosevelt had time on December 16, 1941 to review and sign the Executive Order that established the Refuge (since this was merely days after the attack on Pearl Harbor). Even though there was not yet a road to the Kenai Peninsula, and only a sparse human population in the area, the values and wonders of the Kenai's wildlife and fisheries were recognized and set aside for special recognition and protection. The same values today draw people to the area, who often choose to live here because of the quality of life, even at the expense of higher paying jobs that they might find elsewhere. This is a testament, I like to think, to the success of the Refuge's mandated purposes for wildlife and habitat protection, clean water, and wildlife-dependent recreational opportunities. We expect to have some sort of 60th birthday party this year and we will have an open invitation to everyone to come and help us celebrate.

The winter of 2000/2001 has so far been abnormally mild, both in temperatures and amount of snowfall. While this is an unpleasant situation for winter recreation enthusiasts, it is good news for the wildlife. Lack of deep snow allows the moose to stay at higher elevations and take advantage of food they can't normally reach this time of year, and equally important, lack of snow helps keep the moose off the roads. Mild temperatures and low snowfall help most—but not all—wild creatures survive a difficult time of year. Wolves, however, find it much easier to catch their prey in deep snow. Scavengers such as raven and ermine benefit from the ill fortune of others by feasting on winter-killed animal carrion.

The outlook for fishing seems to be good for next year, and local sockeye anglers will have a new place to try their luck. Two new public fishing areas will open in 2001 within the Moose Range Meadows Subdivision just upriver of Soldotna. This is an area of public easements overlaying private land that have been closed to public access for several years to protect bank habitat. These new sites will provide parking, restroom facilities, boardwalks, and fish cleaning tables, and will be wheel chair accessible.

While South-central Alaska escaped major wild fire events in 2000, the Lower 48 certainly was not as fortunate. I see 2001 as a marked turning point for fire management on Federal public lands throughout the United States. Increased funding and attention should start producing more partnerships and education efforts for fuels reduction projects, wildfire prevention outreach, prescribed fire implementation, and wildfire suppression activities. Additionally, while it is certainly too early to tell, if low precipitation continues throughout the winter, dry conditions in the spring could increase local fire dangers.

It has been approximately 15 years since the Refuge Comprehensive Conservation Plan was completed and it is approaching the time when it will need to be updated. Public scoping for potential plan revisions could begin as early as fall 2001. The entire process is lengthy, probably taking about three years, and will provide ample opportunity for public involvement.

Plans are also underway for a new visitor center on the Refuge to assist the increasing number of visitors traveling to the Refuge each year, and expand outdoor education opportunities for local schools. While we won't be breaking ground in 2001, we do hope to make good progress in planning and design, and invite anyone interested to share their ideas with us.

Hunting opportunities should be as good or better than in 2000. While snowshoe hare numbers are down, other small game populations are doing well, and moose hunting success should be better in 2001. Additionally, there will be some new caribou hunting opportunity in the Tustumena Benchlands due to a steadily growing herd there.

Hikers will find some new places to stretch their muscles. The new Hideout Trail is now open and should provide some great views for hikers throughout the year. It can be accessed about a mile west of

Jim's Landing on the Skilak Loop Road. We also expect work to be completed in 2001 on a trail out of Upper Skilak Lake Campground. This should be a great hike for families and hopefully will be open by the end of the summer.

That's a short list of what I see 2001 bringing to the Kenai National Wildlife Refuge, but whatever else it brings, I hope it brings health, happiness, and joy to all our friends and neighbors on the Kenai Peninsula. Happy New Year!

Robin West is the Refuge Manager for the two million acre Kenai National Wildlife Refuge, which has over 500,000 visitors each year. Previous Refuge Notebook columns can be viewed on the Web at http://kenai.fws.gov.